

**LETTERS TO THE EDITOR****TO THE EDITOR****Enhancing Acute Ischemic Stroke Interpretation With Online Aspects Training**

Acute ischemic stroke (AIS) is a dynamic event that has a narrow therapeutic window measured in hours. Effective treatment of AIS, therefore, depends on the ability of clinicians to rapidly and accurately detect early brain ischemia on non-contrast computed tomogram (CT).<sup>1</sup> Validated to be simple and reliable, the Alberta Stroke Program Early CT Score (ASPECTS) is a semi-quantitative grading method designed for the assessment of AIS in the anterior circulation.<sup>2,3</sup> Based on ASPECTS grading, clinicians may prognosticate and risk stratify patients for therapeutic intervention.<sup>2,4</sup> In recognizing the importance of ASPECTS in AIS treatment and the need for clinicians to be proficient in its usage, we have developed an ASPECTS training website (Figure 1). In this letter, we shall discuss how the design of the website incorporated four key components of online medical education, namely: engaging presentation, quality content, user friendliness and reception to feedback into its design.<sup>5</sup> We shall also analyze on a global scale how users are learning about the website and the temporal trends in the website's usage.

**METHODS**

We have based the design of our website on four of the following criteria:

**1) Engaging Presentation**

The website consists of two principal elements: instruction and training. On the left side in the open browser, users will find didactic teaching dropdown tabs that provide information on the role of ASPECTS and its usage (Figure 1). Moving rightwards, there are training dropdown tabs that provide tutorials through interactive examples and training cases for users to assimilate their knowledge. We have incorporated the use of scrollable CT images to provide users with an interactive image assessment experience.

**2) Quality Content**

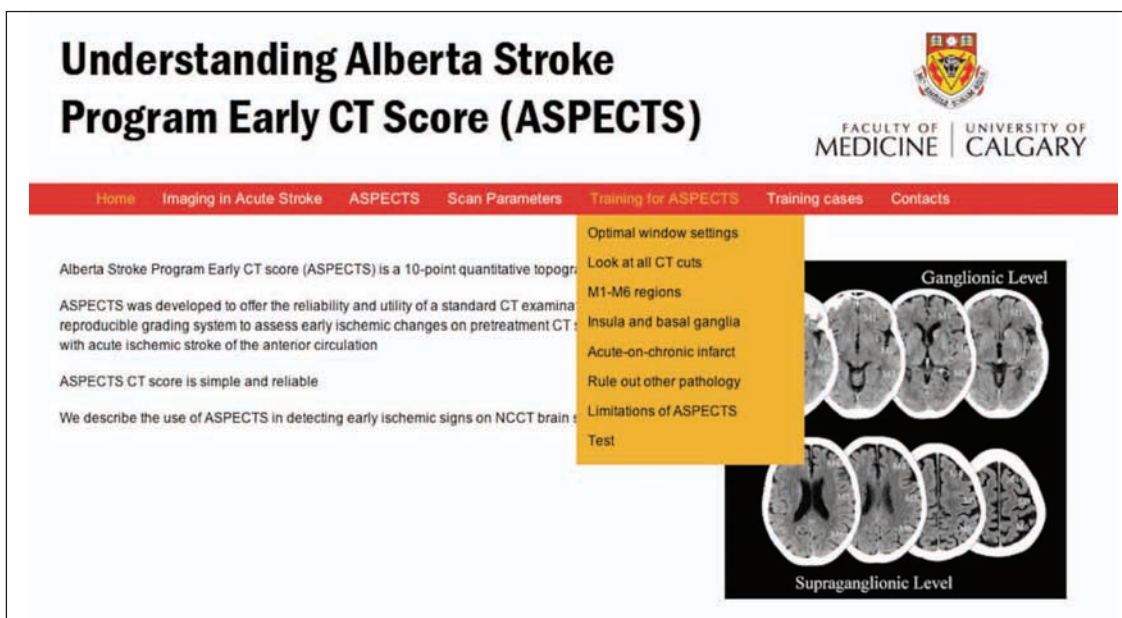
We have weighed the training material to provide users with the most representative clinical cases of AIS. It is our hope that through providing users with the opportunity to learn at their own pace, they will be able to revisit the training cases and reflect on the possible implications as they arise in practice.

**3) User Friendliness**

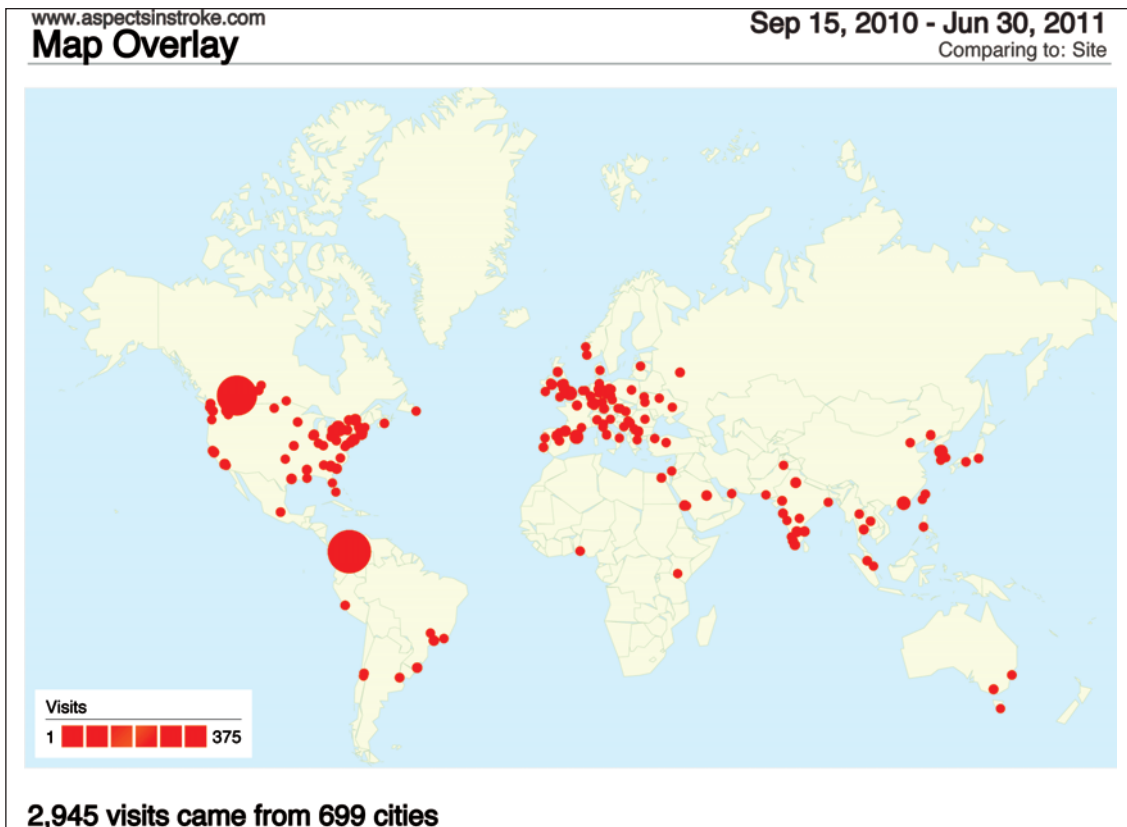
We consulted with a third party website design firm (Internet Simplicity, Inc., San Jose, CA) to maximize user-friendly interfaces and include ergonomic navigation schemes.

**4) Feedback Review and Future Improvements**

We utilized a website usage monitor (Google Analytics) to collect data on user usage time and the geographic location of use to retrospectively study the website's reception by users



**Figure 1:** The home page of [www.aspectsinstroke.com](http://www.aspectsinstroke.com) illustrating the training dropdown menu.



*Figure 2: Worldwide usage of www.aspectsinstroke.com by city. Dot sizes correspond to quantity of usage by a city.*

worldwide. This service can track visitors with respect to their geographic location of use as well as origin of referral (e.g. search engine, advertising link, e-mail link etc).

## RESULTS

From its launch on September 15th, 2010 to June 30th, 2011, 1,898 unique visitors recorded 2,945 visits with 14,021 page views (Figure 2). The average user logged on to the website for 4 minutes and 46 seconds viewing 4.76 pages.

With respect to website usage by nation, it was observed that Canada, USA, Columbia, United Kingdom, and India were the top five countries when counting user-visits (Figure 2). Visitors from Germany browsed the greatest number of pages, viewing an average of 7.03 pages per visit, whereas Canadian visitors logged on for the greatest amount of time averaging 7.15 minutes per visit.

In the ten months after launch, the website showed a clear trend towards increasing usage, with number of visits in the first three months being 392, the second three months being 746, and the latest three months being 1,442.

## DISCUSSION

ASPECTS has been recognized as a simple and reliable grading scale in the interpretation and risk stratification of AIS. We developed this website to provide information about role of

ASPECTS in acute ischemic stroke and its training through instruction and interactive case-based learning. In addition to usage instructions, we have incorporated a series of training examples that allow users to interrogate CT sections in a simulated interactive manner. To replicate real-life learning, each module includes a brief patient history as well as expert commentary on image interpretation. The website includes a list of limitations so that users may be aware of the topographical, image acquisition, and technical limitations of ASPECTS.

To ensure that this website is achieving its goals and to make future improvements, we have set up a website-usage monitor using Google Analytics. The data collected from Google Analytics thus far has demonstrated that the website is becoming increasingly popular.

In addition to the purposes discussed above, future directions for the website are still being explored. Inappropriate image acquisition and interpretation can lead to misdiagnoses and poor treatment outcomes. We believe that this website may reduce variability in patient selection by becoming a training tool for multicenter trials. Investigators can have centers learn and administer competency tests through the website. The website, due to its focus on imaging selection in acute ischemic stroke, could also be expanded to include training modules for other imaging modalities like CT-angiography. In summary, the online interactive ASPECTS training website could potentially play a role in the standardization of AIS diagnoses, be a tool for patient

selection in multicenter clinical trials, and hopefully play a part in the establishment of AIS treatment guidelines in the future.

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#### CONFLICT OF INTERESTS

MG has received honoraria from Penumbra Inc. for speaking engagements.

*Jayesh Modi, Helin Daniel Bai,  
Bijoy K. Menon, Mayank Goyal*

*Departments Of Radiology (JM, HDB, MG)  
Clinical Neurosciences (BKM, MG)  
University Of Calgary, Calgary, Alberta, Canada.*

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#### TO THE EDITOR

#### Repeated Systemic Thrombolysis After Early Recurrent Stroke: Always Hazardous?

The management of early recurrent ischemic stroke (ERIS) represents a challenging clinical problem. Neurological deterioration following improvement (NDFI) may occur after systemic thrombolysis (ST).<sup>1</sup>

Clinical guidelines don't clearly specify how to proceed and in this situation a second ST is considered off-label; in fact, basing on current protocols,<sup>2</sup> any previous stroke within the last three months is listed as a contraindication for ST for the presumed higher risk of intracranial haemorrhage.

We describe the case of a patient with a marked NDFI who underwent a second ST within 40 hours from the first ST. Basing on the available literature, the case we presented is the second<sup>3</sup> report on a patient who received a repeated ST within a few days.

A 73-year-old man was admitted to our Stroke Unit because of sudden onset of mild aphasia and mild right hemiparesis. National Institute of Health Stroke Scale (NIHSS) score was 4. He denied any relevant previous disease, and he was not taking any drug. Non contrast-enhanced brain computed tomography (CT) scan resulted negative for recent vascular lesions.

After informed consent, ST with 69 mg rt-PA was started four hours after stroke onset according to the SITS-MOST protocol. After an initial worsening, the NIHSS score at 24 hours was 0.

Post-procedure CT scan showed no haemorrhagic complications. A treatment with acetylsalicylic acid (ASA) (300 mg/die) and statin was then introduced. Laboratory analysis performed during hospitalization revealed the presence of hyperglycemia and hyperlipidemia. Trans-thoracic echo-

cardiography resulted normal and duplex ultrasound imaging showed no relevant stenosis of internal carotid arteries.

Forty hours after ST, there was a sudden neurological deterioration with appearance of severe aphasia and right-sided hemiplegia, without any significant change in blood pressure. NIHSS score was 12. Non contrast-enhanced CT, compared with the first CT scan, showed neither haemorrhagic complications nor direct or indirect signs of recent ischemic lesions. Magnetic resonance imaging (MRI) showed multiple small foci of diffusion restriction in left fronto-parieto-occipital regions (Figure). The MRI perfusion imaging showed perfusion deficit in the same regions of diffusion restriction. FLAIR and T2-weighted images showed multiple small area of hyperintensity in approximately the same regions of diffusion restriction (Figure). magnetic resonance angiography (MRA) showed neither occlusion nor significant stenosis of internal carotid arteries and middle cerebral arteries.

After an accurate evaluation of both pros and cons, we decided to administer a second full dose of rt-PA. Treatment started 60 minutes after the sudden neurological deterioration. NIHSS was 9 at one hour after the end of the second ST, 3 at two hours and 0 at discharge.

A control MRI performed one day after the second ST showed no substantial variations with respect to the first MRI scan.

When discussing the pros and cons of performing a second ST, we considered mainly the clinical severity of the ERIS and the risk of bleeding after a second ST.

The patient, who had fully recovered after the first ST, presented a sudden severe neurological deterioration before our eyes despite the "best medical therapy" administered (platelet inhibitor and statin).