Published in final edited form as:

J Neuroimaging. 2009 April ; 19(2): 117–118. doi:10.1111/j.1552-6569.2007.00224.x.

New Challenges for Emergent Neuroimaging: Beyond the NISSAN Study

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Keywords

Neuroimaging; acute stroke; emergent; thromboly

As therapeutic options in various neurological emergencies continue to rapidly evolve, it is imperative to establish the diagnosis as early and as accurately, as possible. Neuroimaging is a cornerstone tool for determining a diagnosis, illustrating pathophysiology and guiding serial management of our patients, but many questions remain.

Even in the most extensively studied condition from a neuroimaging perspective, ischemic stroke, considerable controversy persists regarding the optimal imaging modality. Although noncontrast computerized tomography (CT) might be sufficient to exclude intracranial hemorrhage (ICH) in an acute stroke patient, and allow treatment with intravenous tissue-type plasminogen activator (t-PA), it is not sufficient when other emerging therapeutic options are considered. Emerging data on endovascular revascularization, mismatch or penumbra-guided thrombolysis, induced hypertension, cerebral blood flow augmentation, ultrasound-assisted thrombolysis, and other novel approaches are quickly expanding the range of potential interventions and eligible patients.

This is not limited to ischemic stroke. Early and aggressive treatment of hypertension in ICH might be beneficial, and hemostatic therapies in ICH, although so far disappointing, might still emerge beneficial for a subset of patients. Subarachnoid hemorrhage, where emergent intervention is a key element of therapy, is missed in up to 12% of cases, with these patients suffering increased rates of death and disability.¹

In the Neuroimaging in Stroke and Seizure As Neurological emergencies (NISSAN) study looking at current utilization of neuroimaging studies,² about 600,000 patients with various types of stroke were evaluated in 2004 across emergency departments at the national level. This number does not account for the other neurological emergencies, missed diagnoses, and the much larger number of “rule-out” studies. In view of the magnitude of the problem, the societal and public healthcare cost of even minor improvement in our imaging diagnostic algorithms may have significant implications in the midst of a healthcare system under duress.

One notable finding from NISSAN is the apparent underutilization of these diagnostic tools in acute stroke, in the emergency setting. The Buffalo Metropolitan Area and Erie County Stroke Study and other studies³ demonstrated that a large percentage of stroke patients arrive within the first 6 hours, and most within the first day. Thus, the delays in imaging are not completely explained by a subacute presentation to medical attention.

But it will not be enough to answer the what (what imaging study to get), the when (when to get it), the where (emergency department, ward, outpatient), the why (evolving image —“influenced” therapies), and the how. Who will integrate imaging data with clinical aspects and effectively translate such information into rational therapy is a key question. The ability of the treating physician to interpret these studies is essential, maximizing the utility of these studies, sidestepping fragmentation of care, and minimizing delays. When providing emergent care, the treating physician is typically at the bedside, immediately interpreting these studies and using them as a base for major therapeutic decisions. Combining clinical data with often subtle imaging correlates is of utmost value, as imaging is not necessary for obvious diagnoses.

The concerned professional societies and subspecialty disciplines can possibly contribute in several ways: establish and update imaging guidelines, insist on availability and quality benchmarks, require comprehensive and formal training in neuroimaging for trainee physicians, and foster-related research. Progress in therapy will continue to go hand-in-hand with neuroimaging advances. The challenge remains for us to adapt neuroimaging in step with evolving clinical demands.

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