

## Neuroradiology: From Diagnosis to Intervention

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Advances in technology and innovation in radiology has enhanced and expanded the role of radiology in clinical practice and research. Radiology itself has developed further subspecialisation and this issue of *Annals* highlights the subspecialty field of Neuroradiology. There has been tremendous growth in the development of new tools for both diagnosis and intervention in Neuroradiology. Used appropriately, these can positively impact both clinical services and research.

Minimally invasive techniques for the management of neurological diseases continue to evolve. The trained neuro-interventionalist is now able, with his tool box of microcatheters, wires, coils, balloons, stents and embolic agents, to offer both definitive treatment as well as complement the neurologist and neurosurgeon in the co-management of neurological patients. Moreover, the knowledge base and intimate understanding of radiological anatomy and pathophysiology that the neuro-interventionalist brings to the table, enhances greatly the evaluation, planning and treatment or deferment of treatment of these conditions.

The concept of stroke being a “Brain Attack” akin to a heart attack, was first mooted by Dr Vladimir Haschinski, who in 1974, while delivering his inaugural lecture as a faculty member of the University of Toronto, concluded that “the day will come when brain attacks will be treated with the same alacrity as heart attacks” [*Journal of Stroke and Cerebrovascular Disease* 1997;6(4):163-4]. As stroke remains the 4th leading cause of death in Singapore, it is pertinent to be reminded that having a stroke, even if it involves a large vascular territory, does not necessarily equate to a life of disability and dependence. If diagnosed early, and if the patient can be rapidly transported and assessed, new techniques that involve removal of the obstructing intravascular thrombus, either via chemical (thrombolytics) or mechanical (clot retrieval or disruption) means can result in increased recanalisation rates and potentially improve outcome. Lee et al’s study<sup>1</sup> documents the early local experience with mechanical thrombectomy device, with encouraging results and clinical outcomes.

While carotid endarterectomy is the established method of revascularisation in patients with symptomatic carotid stenosis, over the last 2 decades, carotid artery stenting has been increasingly employed as an alternative minimally invasive technique, especially in high surgical risk patients. The technique is fairly straight forward with a 96.8% technical success rate in Gogna et al’s paper.<sup>2</sup> The 30-day morbidity and mortality rates are reported to be marginally higher than published figures, although this may be confounded by the small sample size. One important point raised by the authors is the need to fine-tune patient selection. A significant percentage (>90%) of their patients were symptomatic high surgical risk patients; perhaps these patients were also high risk carotid stenting candidates and may require more stringent selection criteria before being offered therapy.

In the paper by Ong et al,<sup>3</sup> the off-label use of a peripheral vascular closure device to obtain parent vessel occlusion of carotid vessels is a case in point where innovation was born out of necessity. The worldwide difficulty in obtaining a steady supply of detachable vascular occlusion balloons and the less than ideal alternative strategies resulted in physicians thinking out of the box and after careful consideration applying the device, originally designed to close off peripheral vessels, to the carotid and vertebral vessels with good technical and clinical results. The absence of clinically detected neurological deficits is note worthy, and further assessment of safety, perhaps with a study utilising transcranial Doppler or post-interventional diffusion-weighted scans of the brain to assess for silent embolic events should be considered.

The advent of multidetector CT scanners has led to changes in clinical practice, with fast, accurate CT angiography favoured over the more invasive catheter angiography for the emergent assessment of patients suspected of brain aneurysmal rupture<sup>4</sup> and for evaluation of the vascular tree.<sup>5</sup> The ready availability of such CT scanners has enabled fast, safe, less costly and less labour intensive evaluation of the neurovasculature compared to catheter angiography in these situations.

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Rapid imaging with clarity is especially relevant in magnetic resonance imaging (MRI). In this regard, the novel field of antenatal fetal MRI has emerged as an important clinical tool for assessment of the fetal central nervous system clarifying and complementing antenatal fetal ultrasound diagnosis.<sup>6</sup> Indeed the ease of in-vivo high spatial and temporal resolution imaging extending beyond conventional anatomic scans<sup>7</sup> into novel assessments of brain physiology and function, has firmly cemented the vital role of neuroimaging, particularly with MRI, in routine clinical practice.

Functional MRI localisation of eloquent brain areas has now evolved out of the research realm into clinical applications, as illustrated by Rumpel et al's paper<sup>8</sup> on the utility of such pre-surgical evaluation and planning for modern neurosurgery. The ability to map brain function and its white matter fibre connections provides information unique to each individual patient, enhancing the surgical outcomes. The technique may also be used to assess rehabilitation potential.<sup>9</sup>

Inflammatory diseases such as optic neuritis will need assessment of the visual pathway via neuroimaging.<sup>10</sup> An enhanced understanding of disease pathology can only come about with multidisciplinary collaboration, in both clinical care and research, with the goal of achieving superior outcomes at all levels. The timely reviews in this issue, rich with illustrative images, into several complex clinical problems ranging from the very young to the more elderly age groups will be useful to both radiologists and clinicians in their daily practice.<sup>11-14</sup>

Neuroradiology with its modern armamentarium, used in a timely, appropriate manner, has vital contribution in clinical medicine and can guide further appropriate clinical, laboratory or imaging investigations. With the explosion in knowledge and technology, subspecialty expertise and collaboration is required to effectively harness these advances.

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