

MR/IPH for diagnosing carotid artery stenosis: a potential cost-effective imaging tool

Hao Yue (Helena) Lan and Alana Man

With 50,000 cases reported each year, stroke stands as the third leading cause of death in Canada. Given that carotid artery stenosis (CAS) is responsible for approximately 30% of strokes, finding the right diagnostic approach for carotid disease is important to saving lives and healthcare resources. Drs. Tyrrell and Moody from the Department of Medical Imaging at the University of Toronto have recently looked to examine and improve the current model of care for CAS patients. We, Helena Lan and Alana Man, past Research Opportunity Program (ROP) students in the group, had the chance to revisit the topic and to discuss the current status of the project with Dr. Eli Lechtman, a third year medical student in the group.

(AM – Alana Man; EL – Eli Lechtman; HL – Helena Lan)

AM: What is the current practice of diagnosing CAS patients and why are we interested in assessing it?

EL: Ultrasound is the established first-line imaging modality. Although it can reveal the degree of stenosis, it cannot detect important biomarkers of atherosclerotic plaque vulnerability, such as intra-plaque hemorrhage (IPH), which has been shown to predict risk of future stroke. However MR/IPH, a new form of MRI technique developed by Dr. Moody’s group at Sunnybrook, can offer this additional information [1]. With an optimized time per read, referring a patient suspected of CAS for an immediate MR/IPH may be justified.

AM: What steps have you taken to investigate this matter?

EL: After the review of the literature and general practices that

Helena and you had completed, we, with the help of University of Toronto ROP students Kevin Chen, Sylvia Urbanik, Kiersten Thomas, and Indranil Balki, created a cost effectiveness model for carotid stenosis which compared the different patient outcomes and costs, depending on the patient’s condition, imaging modality, and associated factors such as the sensitivity and specificity of the modalities.

HL: What did the model show?

EL: The results demonstrated MRI as an informative and cost-effective diagnostic imaging modality (see Table 1). With that knowledge in hand, we are currently collaborating with the Niagara (heartniagara.com) and Cambridge, Ontario regions to set up a knowledge translation project (with the help of ROP students Julia Robson and Muntaha Nadeem). The project’s objective is to introduce a better way of assessing CAS at the primary care level by determining physicians’ willingness to use MR/IPH as the primary diagnostic imaging modality for CAS and if IPH information is valuable for patients’ risk-assessment of cerebrovascular disease.

HL: Upon gathering physicians’ perspectives, what do you hope to achieve?

EL: We aim to propose the incorporation of the evidence-based diagnostic technology MR/IPH into current medical practice. With its ability to detect a strong predictor of ischemic events, we foresee that MR/IPH can aid physicians in making appropriate treatment decisions for patients with severe CAS. This new technology can lead to improvements in cost-effectiveness and patient care by potentially preventing 1,500 – 2,000 strokes per year in Canada [2].

Table 1. Lifetime Per-Person Clinical Outcomes and Cost Effectiveness Comparison of ultrasound and MR/IPH.

Strategy	First Stroke	Total stroke	Life years	NNS	Surgeries	QALY	Cost (\$)	ICER
Initial age 70								
Ultrasound	0.107	0.121	15.63		0.044	12.14	5896.96	Reference
MRIPH	0.088	0.096	15.66	40.16	0.132	12.20	6075.60	\$3300per/QALY
	Percent reduction	20.6				Cost difference	\$178.64	

Notes: NNS=Number Needed to Screen, QALY=quality-adjusted life-year, ICER=Incremental Cost Effectiveness Ratio