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REPLY LETTER TO EVOLVING THE PROPOSED HEMS STROKE TRIAGING TOOL

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To the Editor:

Thanks to the Cerebral Haemodynamics in Ageing and Stroke Medicine (CHiASM) group members for their thoughtful critique of our recently published paper on helicopter emergency medical services (HEMS) optimization for acute ischemic stroke (AIS). The group raises several important points, and true optimization of any HEMS transport is accelerated when we can all share perspectives. Indeed, our objective was not to provide a definitive triaging tool that fits all clinical environments; rather, we sought to suggest a pragmatic approach and emphasize the critical role of thoughtful HEMS transport in individual and stroke systems of care.

As the authors rightly point out, several large vessel occlusion (LVO) prediction tools have been developed in addition to the long-standing gold standard National Institutes of Health Stroke Scale to improve the probability that the right patient gets to the right center at the right time. Multiple external validation studies have confirmed their relative interchangeability as far as interrater reliability and sensitivities and specificities (1). This is not surprising, given they share the same objective: use clinical observation in the field or during first medical evaluation to predict the likelihood of stroke and its severity. As such, all of these clinical scales are susceptible to many of the same challenges (high false-positive rate, recognition of complex clinical signs). Therefore, the key is to balance sensitivity, specificity, and *feasibility* of implementing the scale in the real world. Nguyen et al. recently published a large head-to-head evaluation of seven LVO prediction scales in a Dutch stroke network of over 2000 AIS patients (2). The objective was to compare accuracy, sensitivities, specificities, and feasibility (defined as the ability to reconstruct the scale from the documented emergency medical service's (EMS) real-time observations) (2). The emphasis on feasibility here is essential, as the value of any given scale can vary with regional differences in geography, patient population, availability of transport, amount of dedicated EMS stroke training, and local policies. Our state is one of only a handful to have EMS protocols mandated by the state legislature. The standardized adoption of one LVO prediction model designed to be used in the field and nimble enough to be customized to respond to our population (in this case, FAST-ED) was adopted as it suits our practice environment. We recognize that other stroke systems may elect a different LVO prediction model based on local factors. This is precisely why we do not advocate the incorporation of any particular scale into the HEMS triage system suggested in our article. Our decision tree is meant to be pragmatic and aims to incorporate only the most basic information reasonable

to expect in the field or first point of contact with an AIS patient to help determine the value of transporting that patient using HEMS resources.

Wide-scale implementation of any LVO prediction tool, as opposed to single-center studies, will be critical to unearth the true value of one scale vs. another in clinical practice. Until such definitive data are available, we must continue to innovate and shift scales' LVO cut-off points as the CHiASM group and others suggest may be done with FAST-ED as a function of distance to stroke center or modify existing scales to include other transfer-critical information such as the patient's baseline functional status, as we have done (3,4).

Along the same line of feasibility of the LVO prediction scale, we must also keep in mind the feasibility of any other information useful to the value of transporting an AIS patient via HEMS. As already mentioned, our group has identified functional status as a key and readily attainable piece of information that directly impacts HEMS value. The reason is straightforward; baseline functional status is one of the most powerful predictors of undergoing endovascular therapy (EVT) in LVO populations (5,6). This is largely in line with the published literature, which exclusively enrolled and treated patients with high baseline functional status as defined by the modified Rankin Scale (mRS) in all the landmark trials establishing EVT as the standard of care for LVO stroke (7). Although the mRS has disadvantages, it is reproducible and is the scale most widely accepted in the field of stroke, therefore establishing it as the tool with the best available evidence. In efforts to improve its usability, we have tried to distill the acceptable baseline status in the EMS setting to "Can the patient walk and wash without the direct help of another?" Although we appreciate that other scales may emphasize different information, the baseline functioning of the LVO patient is critical to their candidacy for EVT.

Although the Clinical Frailty Scale may modestly improve long-term ischemic stroke mortality prediction, the literature supporting its relevant use in the acute setting is difficult to interpret given its retrospective nature, and we have not found it ideal in our local practice (8). Feasibility remains paramount, as this is not a scale routinely employed by our EMS providers or emergency physicians. Furthermore, multiple studies have shown that elderly and more frail patients do more poorly after a large medical insult, including an LVO stroke, as compared with their nonelderly/frail counterparts (9,10). However, in contrast, these patients still derive an independent benefit from undergoing acute stroke treatments (11–14). Therefore, we would be reticent to use any scoring system that would reduce a patient's chances of receiving a treatment with established benefit.

The accurate identification of an AIS patient, as well as the subset who are experiencing an LVO, solely from clinical information available at first contact continues to be one of the greatest challenges to optimizing our systems of stroke care. Biomarkers have been largely infeasible or yielded inconsistent results and attempts to bring the radiology suite or field physicians (e.g., mobile stroke units) to the scene are expensive and not generalizable (15,16). Mobile-based artificial intelligence tools or portable ultrasound devices capable of characterizing brain tissue pulsations profiles consistent with AIS, as the CHiASM group highlights, represent other areas of innovation (17,18). Although much work remains prior

to adequate refinement, these preliminary reports are exciting, and we are hopeful these approaches will lead to enhanced stroke recognition, triage, and ultimately, treatment.

In summary, we acknowledge that effective triage of the AIS patient, including efficient allocation of HEMS transport resources, is a complex and evolving link in the stroke survival chain. We appreciate the CHiASM groups' insights and contributions to the discourse necessary to design a successful HEMS transport decision tool.

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