Commentary: Comparison Between CTA and Digital Subtraction Angiography in the Diagnosis of Ruptured Aneurysms

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The paper by Philipp et al¹ addresses the issues of the reliability of diagnostic imaging modalities in the setting of nontraumatic subarachnoid hemorrhage with particular regard to the sensitivity and specificity of Computed tomography angiography (CTA) vs Digital Subtraction Angiography (DSA). With this retrospective analysis of a large cohort of 401 patients in a single-institution over 4 years, the authors report an overall CTA sensitivity of 71%. In general, it confirms that there are aneurysms that will be missed on CTA, but gives some important nuance to this notion. It provides an interesting stratification of aneurysm size and location, which lends noteworthy remarks: (1) CTA false negatives were as high as 72.7%, 16.2%, and 9.4% with aneurysms measuring 0-3, >3-<5, 5-10 mm, respectively, and (2) aneurysms in the anterior circulation adjacent to bony structures or the skull base and small caliber vessels were more difficult to detect. Amount and location of blood on initial CT were not mentioned. Similarly, there is no stratification for the technical quality of the CTA as a predictor of ability to identify aneurysms.

With an acknowledgment to study limitations such as the retrospective design and heterogeneous data, the authors have given a unique perspective of data reporting, using “real world,” settings to exemplify the importance of considering variations that occur while interpreting results, especially radiographic studies. The stratification of “in-house” vs “outside hospital” CTAs is also worthy of mentioning due to these points. These influences on sensitivity and specificity with, more or less, subjective interpretations through objective imaging findings will always keep us at their mercy. To exercise this thought process, it was reported that the false negative rates of outside CTAs vs in-house CTAs

were 76.7% and 46.4%, respectively. Unfortunately, other important factors as interobserver variability and the conditional flow of information in the real world where an angiogram is most often a second test following a cross-sectional imaging test were not addressed in a comprehensive fashion.

It hardly comes as a surprise that other attempts preceding this have been published, see, for example, MacKinnon et al² who derive slight different results with CTA had 95.2% sensitivity, 97.2% specificity, 98.1% positive predictive value, and 93.2% negative predictive value for ruptured cerebral aneurysms.

With this noted, the authors do stimulate some thought provoking discussion. We have to then consider the variabilities in scenarios and institutions. A large, well-equipped tertiary center, who receives a suspected aneurysmal subarachnoid hemorrhage from the field, would, with its highly trained staff and subspecialties, obtain a CTA and triage the patient according to imaging results. This would be considered standard of care as this facility would be capable of executing required procedures, interpreting data, and providing further care as needed. Contrarily, a facility unable to provide these services—the institutionally known “Outside Hospital”—should ultimately refer these patients to a higher care establishment. Thus, supplying conclusive statements in hopes to provide a general consensus on the standardization of management for suspected aneurysmal subarachnoid hemorrhage patients must cater to both patients and providers universally. It has been recognized in the European literature that a comprehensive management and organizational system of imaging and procedural services must be established to accomplish such ideals.³

It certainly would be exciting to see a study with similar patient populations across multiple institutions with prospectively collected data. While the impetus of this study was to understand whether the current practice could be modified the conclusion and the

ABBREVIATIONS: ROC, receiver-operator characteristics; CTA, Computed tomography angiography; DSA, Digital Subtraction Angiography

data generated from this study are likely not going to support any change of the practice that triages a CTA-negative subarachnoid hemorrhage patient to a DSA. In our practice, we manage potentially aneurysmal subarachnoid hemorrhages using a similar algorithm. As the receiver-operator characteristics (ROC curve) describing the diagnostic yield of CTA or angiography for each institution may vary, depending mostly on the average quality of the institution's in-house CTA, this paper unearths, as a tangible lesson, important considerations on how to conduct an assessment and evaluation based on the local practice.

Multiple studies over the years revealed that a certain proportion of aneurysms will not properly be diagnosed on initial cross-sectional imaging (see, eg, Heit et al⁴). Though delayed imaging, after multiple rounds of initial imaging (including DSA under certain circumstances), may identify vascular lesions that could have been missed (see Delgado et al⁵) with a comprehensive diagnostic pathway, complete certainty remains elusive. One may conclude that a CTA as the sole diagnostic imaging study to evaluate a patient with a nontraumatic likely aneurysmal subarachnoid hemorrhage, is insufficient as a standard and a DSA must subsequently be pursued at least in the acute setting. It may be reasonable to deviate from this in the setting of rather benign perimesencephalic SAH as long there is a clear understanding what sets this entity apart from the rather complicated diffuse angiogram negative SAH (see Hui et al;⁶ Andaluz and Zuccarello;⁷ Walcott et al⁸).

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