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ACCURACY OF CT ANGIOGRAPHY IN EVALUATING THE ACUTE STROKE (ISCHEMIC AND HEMORRHAGIC)

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ABSTRACT

CT angiography (CTA) is a recognized minimally intrusive tool for imaging of most significant vessels in the body. We aimed by this review to evaluate the accuracy of CT angiography (CTA) in detection and exclusion of Acute stroke whether ischemic or homographic stroke. We conducted a detailed search of literature through the databases; PubMed (MIDLINE) and Embase, for studies related to our concerned topic our research was through the November-December of 2016. Search key words included: Computed Tomography Angiography and CTA, combined with ischemic stroke, cerebral ischemia, Hemorrhagic stroke or cerebrovascular disorder. References of identified articles were also searched for more relevant studies. Computed tomography Angiography (CTA) supply reliable diagnostic tools in intense stroke. Even if quantitative analysis is not utilized, the sensitivity to identify severe cerebral infarction is considerably increased compared to native CT alone. An innovative CT procedure including and CTA is well adjusted to the function of quick triage of patients thought to have a stroke. Routes showed CTA demonstrates a considerable or large thrombus problem outside the three-hour time window, and with that could be an effective and really accurate procedure for both ischemic and hemorrhagic stroke.

KEYWORDS: CT angiography Computed tomography Angiography (CTA) supply reliable diagnostic tools in intense stroke.

INTRODUCTION

Stroke is a leading cause of death and special needs after cardiovascular diseases worldwide.[1,2] Imaging plays an important function in examining patients suspected of intense stroke and transient ischemic attack (TIA), especially before initiating treatment. The primary objective of imaging patients with severe stroke signs is to compare hemorrhagic and ischemic stroke. In ischemic stroke patients, secondary objectives of imaging before initiating revascularization interventions with intravenous thrombolysis or endovascular treatments include recognition of the area and degree of intravascular embolisms in addition to the existence and extent of "ischemic core" (irreversibly damaged tissue) and "penumbra" (hypoperfused tissue at risk for infarction).[3,4,5]

Ischemic stroke is specified as an occasion defined by the unexpected beginning of severe focal neurologic deficit most likely attributable to cerebral ischemia after exemption of hemorrhage by CT. Diagnosis of ischemic stroke can be much better if thrombolytic therapy is administered to patients within the first three hours.[6,7] Neuroimaging plays a crucial function in the examination of patients believed to have severe ischemic stroke. Because of the current advances in computed tomography (CT), it now offers details beyond the simple presence or absence of intracranial hemorrhage. Nowadays, Multislice CT stroke protocol, consisting of noncontrast head CT [NCT], and CT angiography (CTA).[6,7]

CT angiography (CTA) is a recognized minimally intrusive tool for imaging of most significant vessels in the body. It can almost entirely alternative to arterial angiography in the diagnostic evaluation of the most common vascular diseases but has not knowledgeable large spread use when vessels besides the aorta and pulmonary arteries were involved. The factor for this were the limitations of spatial resolution when longer scan ranges needed to be covered and the cumbersome information editing and processing tools available in the past.[8,9] With the introduction of multislice CT in 1998 and with increasingly simple and quick postprocessing workstations, CTA has actually experienced a substantial increase and is now readily available for regular use in most diagnostic settings. At present, a lot of significant vendors use multislice CT with subsecond rotation (0.5-0.8 s) and four active detector rows. These scanners are now as much as 8 times faster than 1 s spiral CT scanners and permit almost isotropic imaging (1 mm sections) and extremely long scan ranges of up to 150 cm[9,10,11]

We aimed by this review to evaluate the accuracy of CT angiography (CTA) in detection and exclusion of Acute stroke whether ischemic or homographic stroke, we intend to present evidence in favor of the use of CTA, highlight the disadvantages of this imaging modality, and present a model based on our experience at utilizing CTA for decision making in acute stroke.

METHODOLOGY

We conducted a detailed search of literature through the databases; PubMed (MIDLINE), and Embase, for studies related to our concerned topic our research was through the November-December of 2016. Search key words included: Computed Tomography Angiography and CTA, combined with ischemic stroke, cerebral ischemia, Hemorrhagic stroke or cerebrovascular disorder. References of identified articles were also searched for more relevant studies. We have limited our search to English language, and to only human Trails.

RESULTS AND DISCUSSION

Imaging studies are used to exclude hemorrhage in the acute stroke patient, to assess the degree of brain injury and to identify the vascular lesion responsible for the ischemic deficit. CTA is a minimally invasive study that requires a time optimized rapid injection of intravenous contrast and thin-section helical CT images are obtained in the arterial phase. Software allows thin-section axial CT images to be reformatted in any plane enabling a more complete evaluation of vessels. Three-dimensional reformations of contrast-enhanced CTA provide clear images of cerebral blood vessels. Imaging of the entire intra and extra cranial circulation beginning at the aortic arch and continuing through the Circle of Willis can frequently be performed within 60 seconds (**Fig. 1**).[11,12,13] The identification of areas of stenosis or occlusion of vessels allows for rapid and accurate diagnoses and decisions in the clinical arena. CTA that identify occluded blood vessels in the brain assist the neurologist and emergency physician in treatment decisions.[14,15]

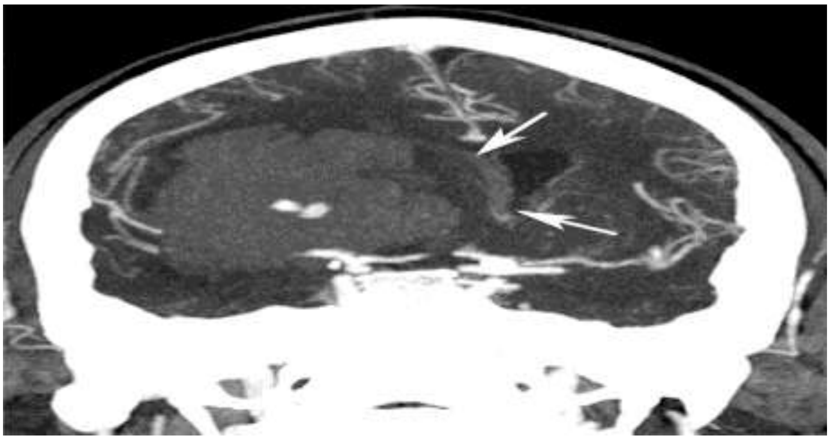

Fig.1: Hypertensive intraparenchymal hematoma with subfalcine herniation. Coronal two-dimensional reconstruction from a computed tomography angiogram demonstrates transfalcine herniation (arrows) to the left due to large right sided intraparenchymal hemorrhage.[15]

Roles of Computed Tomography Angiography (CTA) in diagnostic accuracy

Hypoattenuation on CTA source image is an indication of lowered cerebral blood volume in the area of ischemia (**Fig. 2**).[16] These hypoattenuation attributes are not as time reliant as hypoattenuation due to anemia on noncontrast CT (NCCT).[17] Areas of hypoattenuation on CTA source image correlate well with sores on diffusion-weighted image (DWI) and are for that reason a marker of core or irreversibly infarcted brain tissue at discussion.[17,18] Various research studies[18,19,20] have likewise shown that CTA source image improves the prediction of last infarct size and clinical result when compared with NCCT, more so in patients providing ultra-early.[19] With new generation scanners, a distinction needs to be made between CTA source image obtained throughout the arterial phase and images obtained during the venous phase. Computed tomography angiography source images gotten during the arterial stage are flow weighted and suggest brain region with decreased cerebral blood circulation when compared with images acquired throughout the venous phase which are more blood volume weighted and thus much better approximate irreversibly infarcted brain tissue.[19] This difference is attended to sufficiently with brand-new generation scanners with whole brain protection, which offer whole brain perfusion images in addition to time-resolved CTA images of the intracranial flow. The utility of CTA source images might end up being doubtful with the accessibility of brand-new generation scanners.[20,21] Up until then, CTA source images have a function in marking irreversibly infarcted brain tissue in patients presenting with severe ischemic stroke.[21]

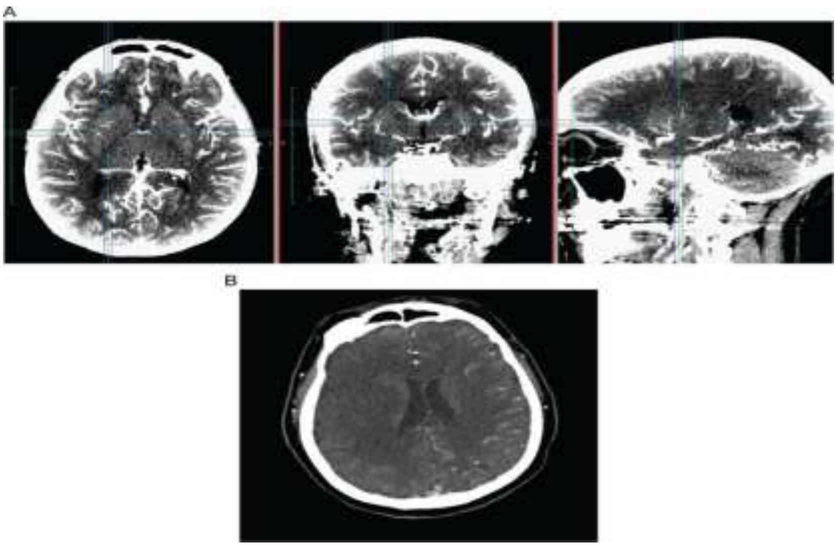

Fig.2: CTA source images in all 3 planes windowed for optimal imaging of hypoattenuation of contrast. B, Computed tomography angiography (CTA) source image showing hypoattenuation of contrast in the right middle cerebral artery territory

in a patient who presents with an acute ischemic stroke and left hemiplegia with hemineglect.[16]

CTA Assists in estimating the level of occlusion in the arterial tree (the thrombus burden). When compared to endovascular therapy[21,22], recanalization rates in patients with proximal occlusions are substantially lower with IV tPA. Amongst 388 patients with proximal occlusions in the CTA database at our center, 127 patients went through even more imaging to examine recanalization of which only 27 (21.3%) patients had severe recanalization. Recanalization was evaluated initially utilizing angio pictures of a standard cerebral angiogram in patients going to the angiosuite for endovascular treatment or on transcranial doppler within 2 hours of IV tPA. By occlusion subtype, the rates of recanalization were distal internal carotid artery (ICA) (4.4%); M1-middle cerebral artery (MCA) (32.3%); M2-MCA (30.8%); and basilar artery (4%) (23). Early recanalization is a powerful independent predictor of good scientific outcome (24). Provided the low rates of recanalization with IV tPA in proximal occlusions, vascular imaging utilizing CTA might possibly work in triaging patients for suitable recanalization treatment. Computed tomography angiography can be utilized to assess the degree of thrombus in the arterial tree using a clot burden score (**Fig. 3**).[25] With increasing CBS values (ie, less thrombus problem), patients are significantly more likely to have an independent practical outcome and less most likely to pass away. In addition, final infarct sizes are smaller sized and hemorrhagic change rates lower (25). Higher CBSs (smaller sized embolisms) were connected with higher recanalization rates in a recent study by Tan and colleagues.[26]

Fig. 3: Clot burden score demonstrating the extent of clot on computed tomography angiography (CTA) in the anterior circulation in patients with acute ischemic stroke.[25]

We identified a very important study[11] that performed diagnostic CTA obtained in 54 patients: catheter angiography (digital subtraction angiography) verified the CTA findings in 12 of 14 patients (86%). And the outcomes of this research study showed that the CTA was effectively completed in 54 patients. Time from sign onset to CTA was <6 hours in 38 patients (70%), in between 6 and 12 hours in 14 patients (26%), and uncertain in 2 patients (4%). Occlusion or high-grade stenosis accounting for the patient's signs was identified on CTA by the study neuroradiologist in 30 patients: 11 in the middle cerebral artery stem (M1 segment), 9 in a main middle cerebral artery branch (M2 sector), 7 in the distal internal carotid artery, and 1 each in the vertebral, posterior cerebral, and anterior cerebral arteries. Eight patients with evidence of occlusion on CTA received instant intravenous tPA inning accordance with NINDS procedure. 9 others got immediate DSA for possible thrombolysis; CTA analysis made at presentation was validated by DSA in all 9 patients. One of these patients had bilateral vertebral artery occlusions that were properly determined on CTA at presentation however were missed when the CTA was read for research study functions. A case in point is shown in (Fig. 4) in a patient with an M1 occlusion demonstrated on a coronal CTA forecast and validated by DSA performed right away later. The CTA has the ability to clearly show the occlusion along with the security supply to the occluded vessel by means of the pial flow.[11]

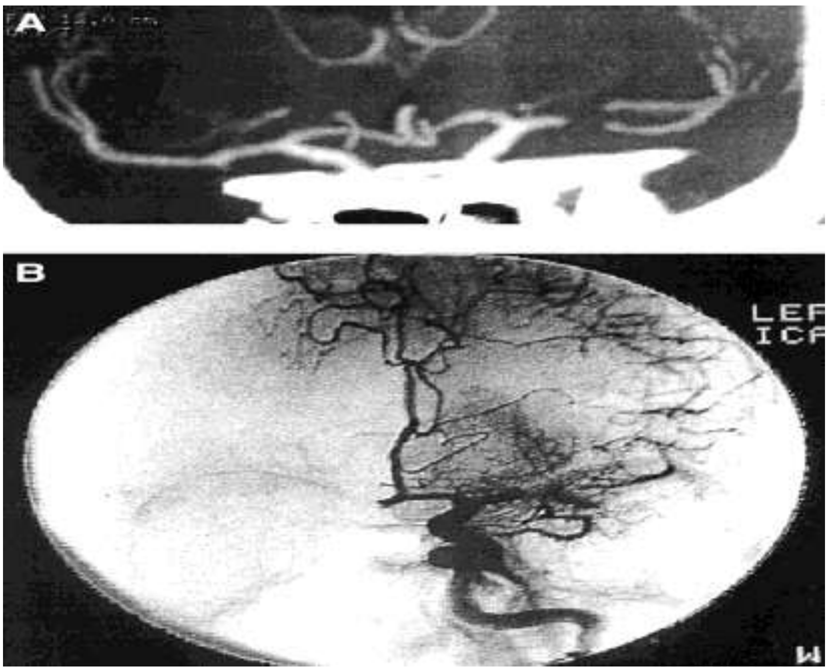

Fig. 4: CTA performed 4 hours after symptom onset, demonstrating occlusion of distal left middle cerebral artery stem with collateral supply via pial vessels to distal middle cerebral artery branches. B, DSA performed immediately after CTA and resembling it

closely, including identical site of occlusion and evidence of pial collateral supply to distal middle cerebral artery branches.[11]

One study[7] revealed initial results which were excellent for the detection of kidney artery stenoses: CTA does not only offer info about the degree of a stenosis but also shows the existence of hard- or soft-plaques and accessory arteries. Sensitivity and uniqueness can be anticipated to be well are above 95% if vessels are examined in perpendicular and longitudinal areas in addition to with MIP or VRT displays. A regular CTA essentially excludes the existence of a stenosis; hence the method can be used as a screening tool to determine patients that make money from PTA.[26,27,28,29,30] It likewise offers important additional information for the interventional radiologist, such as the existence of mural stenoses or an irregular anterior origin of a renal artery.

CONCLUSION

Computed tomography Angiography (CTA) supply reliable diagnostic tools in intense stroke. Even if quantitative analysis is not utilized, the sensitivity to identify severe cerebral infarction is considerably increased compared to native CT alone. An innovative CT procedure including and CTA is well adjusted to the function of quick triage of patients thought to have a stroke. routes showed CTA demonstrates a considerable or large thrombus problem outside the three-hour time window and with that could be an effective and really accurate procedure for both ischemic and hemorrhagic stroke.

REFERENCES

1. National Institute of Neurological Disorders and Stroke rtPA Stroke Study Group. Tissue plasminogen activator for acute ischaemic stroke. N Engl J Med., 1995; 33: 1581–1587.
2. American Heart Association. Stroke Facts. American Heart Association, Dallas, Tex, 1999.
3. Rowley HA. Extending the time window for thrombolysis: evidence from acute stroke trials. Neuroimaging Clin N Am., 2005; 15: 575–87.
4. Sims J, Schwamm LH. The evolving role of acute stroke imaging in intravenous thrombolytic therapy: patient selection and outcomes assessment. Neuroimaging Clin N Am, 2005; 15: 421–40.
5. Schellinger PD. The evolving role of advanced MR imaging as a management tool for adult ischemic stroke: a Western-European perspective. Neuroimaging Clin N Am, 2005; 15: 245–58.

6. J.M. Wardlaw. Overview of Cochrane thrombolysis meta-analysis. Neurology, 2001; 57: 69–76.
7. M. Prokop. Multislice CT angiography. Eur J Radiol, 2000; 36: 86–96.
8. Rubin GD, Shiau MC, Leung AN, Kee ST, Logan LJ, Sofilos MC. Aorta and iliac arteries: single versus multiple detector-row helical CT angiography. Radiology, 2000; 215: 670–6.
9. Hu H. Multi-slice helical CT: scan and reconstruction. Med Phys, 1999; 26: 5–18.
10. Klingenbeck Regn K, Schaller S, Flohr T, Ohnesorge B, Kopp AF, Baum U. Subsecond multi-slice computed tomography: basics and applications. Eur J Radiol, 1999; 31: 110–24.
11. Verro P1, Tanenbaum LN, Borden NM, Sen S, Eshkar N. CT angiography in acute ischemic stroke: preliminary results. Stroke, Jan, 2002; 33(1): 276-8.
12. Torres-Mozqueda F, He J, Yeh IB, et al. An acute ischemic stroke classification instrument that includes CT or MR angiography: The Boston Acute Stroke Imaging Scale. AJNR Am J Neuroradiol, 2008; 29: 1111–7.
13. Wintermark M, Ko NU, Smith WS, et al. Vasospasm after subarachnoid hemorrhage: utility of perfusion CT and CT angiography on diagnosis and management. AJNR Am J Neuroradiol, 2006; 27(1): 26–34.
14. Srinivasan A, Goyal M, et al. State of the art imaging of acute stroke. Radiographics, 2006; 26: S75–S95.
15. Birenbaum D, Bancroft LW, Felsberg GJ. Imaging in Acute Stroke. *Western Journal of Emergency Medicine*, 2011; 12(1): 67-76.
16. Menon BK, Demchuk AM. Computed Tomography Angiography in the Assessment of Patients With Stroke/TIA. *The Neurohospitalist*, 2011; 1(4): 187-199. doi: 10.1177/1941874411418523.
17. Schramm P, Schellinger PD, Klotz E, et al. Comparison of perfusion computed tomography and computed tomography angiography source images with perfusion-weighted imaging and diffusion-weighted imaging in patients with acute stroke of less than 6 hours' duration. Stroke, 2004; 35(7): 1652–1658.
18. Lev MH, Segal AZ, Farkas J, et al. Utility of perfusion-weighted CT imaging in acute middle cerebral artery stroke treated with intra-arterial thrombolysis: prediction of final infarct volume and clinical outcome. Stroke, 2001; 32(9): 2021–2028.
19. Sharma M, Fox AJ, Symons S, Jairath A, Aviv RI. CT angiographic source images: flow- or volume-weighted? AJNR Am J Neuroradiol, 2011; 32(2): 359–64.

20. Orrison WW, Jr, Snyder KV, Hopkins LN, et al. Whole-brain dynamic CT angiography and perfusion imaging. Clin Radiol, 2011; 66(6): 566–574.
21. del Zoppo GJ, Poeck K, Pessin MS, et al. Recombinant tissue plasminogen activator in acute thrombotic and embolic stroke. Ann Neurol, 1992; 32(1): 78–86.
22. Saqqur M, Uchino K, Demchuk AM, et al. Site of arterial occlusion identified by transcranial Doppler predicts the response to intravenous thrombolysis for stroke. Stroke, 2007; 38(3): 948–954.
23. Bhatia R, Hill MD, Shobha N, et al. Low rates of acute recanalization with intravenous recombinant tissue plasminogen activator in ischemic stroke: real-world experience and a call for action. Stroke., 41(10): 2254–2258
24. Rha JH, Saver JL. The impact of recanalization on ischemic stroke outcome: a meta-analysis. Stroke, 2007; 38(3): 967–973
25. Puetz V, Dzialowski I, Hill MD, et al. Intracranial thrombus extent predicts clinical outcome, final infarct size and hemorrhagic transformation in ischemic stroke: the clot burden score. Int J Stroke, 2008; 3(4): 230–236.
26. Beregi JP, Louvegny S, Gautier C, Mounier-Vehier C, Moretti A, Desmoucelle F, Wattinne L, McFadden E. Fibromuscular dysplasia of the renal arteries: comparison of helical CT angiography and arteriography. AJR, 1999; 172: 27–34.
27. Berg MH, Manninen HI, Vanninen RL, Vainio PA, Soimakallio S. Assessment of renal artery stenosis with CT angiography: usefulness of multiplanar reformation, quantitative stenosis measurements, and densitometric analysis of renal parenchymal enhancement as adjuncts to MIP film. J Comput Assist Tomogr, 1998; 22: 533–40.
28. Galanski M, Prokop M, Chavan A. Renal arterial stenoses: spiral CT angiography. Radiology, 1993; 189: 185–92.
29. Halpern EJ, Wechsler RJ, DiCampli D. Threshold selection for CT angiography shaded surface display of the renal arteries. J Digit Imaging, 1995; 8: 142–7.
30. Kaatee R, Beek FJ, de Lange EE, van Leeuwen MS, Smits HF, van der Ven PJ, Beutler JJ, Mali WP. Renal artery stenosis: detection and quantification with spiral CT angiography versus optimized digital subtraction angiography. Radiology, 1997; 205: 121–7.