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COMPUTED TOMOGRAPHY ANGIOGRAPHY VERSUS DIGITAL SUBTRACTION ANGIOGRAPHY FOR INTRACRANIAL VASCULAR PATHOLOGY

Radio-Diagnosis

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ABSTRACT

Computed tomography angiography is non-invasive and readily available technique for assessment of intracranial vascular lesions. It has broad acceptance by patients and is relatively inexpensive. However, there are some shortcomings with this modality, such as the decreased accuracy in small pathologies or calcified vessels and inability to assess dynamic cine view. DSA, on the other hand, provide excellent characterization and excellent anatomic delineation of small and large vascular pathologies. There is a significant difference, in the inherent costs of DSA and CTA. In this article We have studied various intra cranial vascular pathologies on both CTA and DSA and compared their sensitivity and specificity for diagnosis. The comparative study was carried out with 80 patients. According to this study, computed tomography angiography remains the first line of imaging for the intracranial pathology with high diagnostic accuracy rates with 92.4% sensitivity and 92.5% accuracy. In 5 patients where CTA were inconclusive, DSA was diagnostic investigation.

KEYWORDS

Digital subtraction angiography, computed tomography angiography, CTA, DSA, intracranial pathologies.

INTRODUCTION

Computed tomography angiography is non-invasive and readily available technique for assessment of intracranial vascular lesions. Due to significant development of CT techniques (i.e., multislice, helical CT) the modality becomes fast, first diagnostic choice in cranial pathologies. However, there are some shortcomings are with this modality such as decreased accuracy in small pathologies or calcified vessels and inability to assess dynamic cine view.

Digital subtraction angiography, on other hand is fluoroscopic technique with subtracted radiopaque structure provide excellent characterization and excellent anatomic delineation of small and large vascular pathologies. But it is an invasive and time-consuming technique with a risk of symptomatic complications in 0.5-2%. In this article we will characterize intracranial vascular lesion on both CTA and DSA and will look for sensitivity and specificity of CTA for picking up lesion accurately.

AIMS AND OBJECTIVES

1. To study computed tomography angiography as compared to digital subtraction angiography for intracranial vascular pathology.
2. To assess diagnostic validity of computed tomography angiography as compared to digital subtraction angiography.

MATERIAL AND METHOD

The comparative study was carried out in Government Medical College, Nagpur over duration of 2 years. 80 patients were included in the study. Place – Government Medical College, Nagpur

Inclusion Criteria-

- Patients who were suspected of having intracranial vascular pathology.
- Patient with non-traumatic SAH in CT head plain scan.

Exclusion Criteria-

- Patient with traumatic subarachnoid hemorrhage and Intra parenchymal hemorrhage
- Patient who are not ready to give consent.
- Patient who are allergic to iodine contrast agent.
- Patient with chronic kidney disease.
- Hemorrhagic diathesis
- Anticoagulant therapy (unless previously discontinued with restoration of normal clotting time)
- Extremely debilitated & terminally ill patients

All patients underwent a standardized acute ICH evaluation that included unenhanced CT followed by multiphase CT angiography. All CT angiography examinations were performed from the arch of aorta to the vertex with a 256 slice CT machine. Images were acquired with thin section (0.5mm) for unenhanced CT and multiphase CT angiography. The first phase acquisition was timed to occur during the peak arterial phase, the second during the peak venous phase. The first phase was triggered by monitoring the bolus of contrast material from the descending aorta; scanning started after the CT attenuation value of the aorta reached the threshold value of 120 HU. A total of 80 mL of contrast material (370 mg Iodine per ml, Iopromide, Ultravist 370) was injected at a rate of 4 mL/sec; this was followed by a 30-mL normal saline chase at a rate of 4 mL/sec. DSA images were obtained by a bi-plane angiographic unit and the procedures were performed by 2-3 interventional radiologists. Diagnostic 6-vessel angiography was performed via retrograde approach by catheterization of the right femoral artery. Standard views comprising antero-posterior, lateral and towne's projections (30 degree cranial) of bilateral internal and external carotid and one of the vertebral arteries were obtained following injection of nonionic contrast medium by hand. Oblique and other additional views were obtained, if necessary, to further delineate the vascular anatomy. Amount of contrast medium used was approximately 70-80 ml per study. 3DRA, were acquired during a 200° rotational run in 8 seconds with 15 ml of contrast medium injected at rate of 3 ml/s, if required for further evaluation.

OBSERVATION AND RESULTS

Among 80 CT plain suspected patients, CT angiography able to detect 62 patients with intracranial pathology while 18 patients had no detectable vascular pathology. Out of total 62 CTA positive vascular pathologies, 61 patients were detected at DSA, 5 aneurysms which missed on CTA were detected on DSA. The location of aneurysm found on CTA are concordance with that of DSA in 100% cases. Of the 56 patients who were detected with aneurysm on CTA, most common location of aneurysms was supraclinoid ICA in 21 patients (37.5%) remaining aneurysms were detected at MCA, ACA, ACOM, basilar, PCOM, Vertebral artery constitute 7 (12.5%), 5 (8.9%), 15 (26.8%), 2 (3.6%), 5 (8.9%), 1 (1.8%) patient respectively. Total number of small sized aneurysms detected by CTA was 7. Out 11 small sized aneurysms detected by DSA, 5 aneurysms were missed on CTA. While out of CTA positive 7 aneurysms, 1 of the aneurysms not detected in DSA. Total number of medium sized aneurysms detected by CTA were 38, also confirmed on DSA, there are 2 medium sized aneurysms on CTA were seen as large sized in DSA. Total number of medium sized aneurysms detected by CTA were 9. also confirmed on DSA, there are 2 medium sized aneurysms on CTA were seen as large sized in DSA. Among the total 54 saccular aneurysms demonstrated on DSA, only 52 were detected on CTA. Out of 5 CTA negative aneurysms, 3 aneurysms were demonstrated as saccular and 2 were demonstrated as fusiform. CTA vs

DSA for all intracranial vascular pathologies: We derived the sensitivity, specificity, PPV and NPV for our study were 92.4%, 92.8%, 98.4% and 72.2 % respectively. Significant association was noticed between CTA and DSA (P< 0.001). The diagnostic accuracy came out to be 92.5%. The sensitivity, specificity, PPV and NPV of CT angiography compared to DSA for evaluation of small sized aneurysms were 54.5%, 97.5%, 85.7% and 88.6% respectively. The sensitivity, specificity, PPV and NPV of CT angiography compared to DSA for evaluation of medium sized aneurysms were 100%, 91.3%, 95% and 100% respectively. The sensitivity, specificity, PPV and NPV of CT angiography compared to DSA for evaluation of large aneurysms were 81.5%, 100%, 100% and 96.1% respectively. The sensitivity, specificity, PPV and NPV of CT angiography compared to DSA for evaluation of saccular aneurysms were 98.1%, 100%, 96.2% and 40% respectively.

Table 1: Overall Accuracy Of CT Angiography And Digital Subtraction Angiography

Pathology On CT	Pathology on DSA				Total
	NO		YES		
	Freq	%	Freq	%	
NO	13	72.2	5	27.8	18
YES	1	1.6	61	98.4	62
Total	14	18.9	66	81.1	80

Table 2 Accuracy Of CT Angiography And Digital Subtraction Angiography According To Aneurysms

Aneurysm On CTA	Aneurysm On DSA		
	NO	YES	TOTAL
NO	19	5	24
YES	1	55	56
TOTAL	20	60	80

Table 3 Comparison Between CTA And DSA For Identification Of Small (≤4mm) Sized Aneurysms

CTA	DSA		
	Positive for small size	Negative for small size	Total
Positive for small size	6	1	7
Negative for small size	5	39	44
Total	11	40	

Table 4 Comparison Between CTA And DSA For Identification Of Medium (4-12mm) Sized Aneurysms

CTA	DSA		
	Positive for medium size	Negative for medium size	Total
Positive for medium size	38	2	40
Negative for medium size	0	21	21
Total	38	23	

Table 5 Comparison Between CTA And DSA For Identification Of Large (>12mm) Sized Aneurysms

CTA	DSA		
	Positive for large size	Negative for large size	Total
Positive for large size	9	0	9
Negative for large size	2	50	52
Total	11	50	

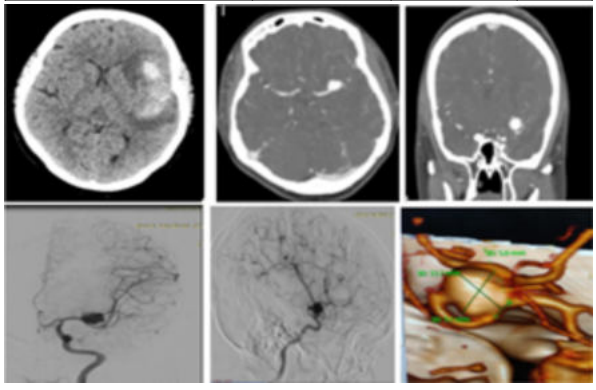

Figure 1 Left Middle Cerebral Artery Aneurysm With Subarachnoid And Intraparenchymal Hemorrhage

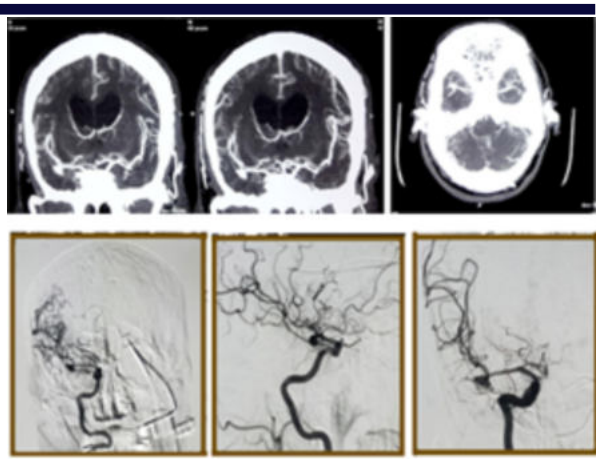

Figure 2 Right Middle Cerebral Artery Aneurysm

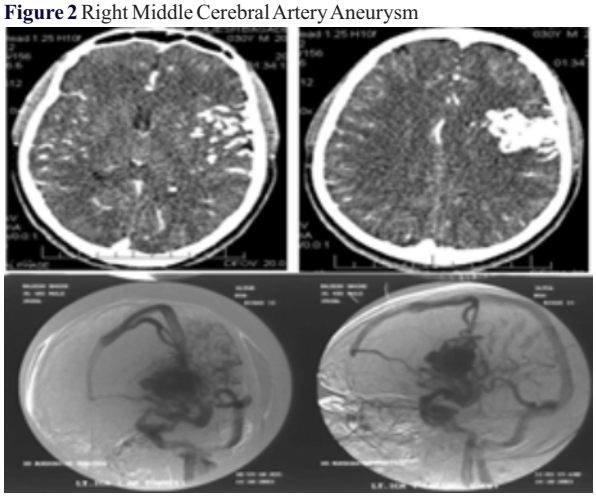

Figure 3 Right Frontal Temporal Parietal Arteriovenous Malformation.

CONCLUSIONS

Thus, Ct angiography has fairly high sensitivity, specificity, PPV, NPV as compared to digital subtraction angiography in diagnosis of intracranial pathologies i.e., 92.4%, 92.8%, 98.4% and 72.2 % respectively. The sensitivity, specificity, PPV and NPV of CT angiography compared to DSA for evaluation of aneurysms were 91.6%, 95%, 98.2% and 79.1 % respectively.

This makes CT angiography a comparable and initial investigation choice for diagnosis of intracranial pathologies, In spite of, the high sensitivity and diagnostic accuracy of CT angiography, DSA still remains the definitive diagnostic tool for intracranial pathologies. The characterization of intracranial pathologies by CT angiography cannot completely replace DSA and there is further scope for improvements and standardization in the imaging.

REFERENCES:

1. Kumar CS, Anil KVD, Prasad KSV, Raman B. Comparison of the Role of CT Angiography and DSA in Detecting Aneurysms in Cases with Spontaneous Subarachnoid Hemorrhage. Int J Sci Stud 2017;5(8):23-27.
2. Maniharan, S., Athukorala, A.D.P., Pullaperuma, D.L.N., Pirasath, S. and Lekamge, I.N., 2019. Role of digital subtraction angiography in detection of intracranial aneurysms compared with computed tomographic angiography. Sri Lanka Journal of Radiology, 5(1), pp.19–30.
3. Yoon DY, Lim KJ, Choi CS, Cho BM, Oh SM, Chang SK. Detection and characterization of intracranial aneurysms with 16-channel multidetector row CT angiography: a prospective comparison of volume-rendered images and digital subtraction angiography. AJNR Am J Neuroradiology. 2007 Jan;28(1):60-7. PMID: 17213425; PMCID: PMC8134101.
4. Tipper G, U-King-Im JM, Price SJ, Trivedi RA, Cross JJ, Higgins NJ, Farmer R, Wat J, Kirollos R, Kirkpatrick PJ, Antoun NM, Gillard JH. Detection and evaluation of intracranial aneurysms with 16-row multislice CT angiography. Clin Radiol. 2005 May;60(5):565-72. doi: 10.1016/j.crad.2004.09.012. PMID: 15851044.