EVALUATION OF INTRA CRANIAL ANEURYSMS (ICA) BY MULTIDETECTOR COMPUTED TOMOGRAPHY ANGIOGRAPHY (MDCTA)

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ABSTRACT

INTRODUCTION: Digital subtraction angiography (DSA) is considered as gold standard for the detection and therapeutic decision making regarding ICA. However, DSA is invasive and costly as compared to CTA, which is accurate, easy, noninvasive and readily available and provide pragmatic information regarding appropriate management of ICA. **METHODS:** Retrospective case series with short term follow up of patients diagnosed with ICA on MDCTA between year 2006 and 2009 at our diagnostic radiology centre. CTA was performed on Toshiba aquilion 64 slice MDCT machine. Two dimensional maximum intensity projection (MIP) views and three dimension volume rendered reconstructions were done from raw images. The presence of an aneurysm, size, number, morphology, its parent and feeding vessels and associated findings i.e. hemorrhage & spasm were noted. **RESULTS:** We found 18 patients with ICA, three were excluded. In 15 patients, mean age ± standard deviation was 45.8±13.8. Six were males (40%) and 9 females (60%) with mean length ± standard deviation of aneurysm was 7.6 ±3.6 (3-12 mm) and width of 6.2±2.5 (2-10 mm). All had single aneurysm; middle cerebral artery was most common site. Signs of ruptured aneurysm were found in nine (53%) and two expired (17.9%). **CONCLUSION:** Our case series supports the use of MDCTA alone for the effective evaluation of ICA of ≥ 2 mm without any further investigations.

Keywords: Intracranial aneurysm, MDCTA, Angiography

Introduction

The incidence of the Intracranial aneurysms (ICA) in general population is 0.2-8%[1] and are usually discovered when ruptured; causing SAH in 90% of cases.[2] Less frequency they manifest as mass effect and discovered incidentally during neuroradiologic examination performed for different diagnostic purposes.

Prompt radiological evaluation of ruptured intracranial aneurysm is critical for determining appropriate treatment. Currently digital subtraction angiography (DSA) is considered as gold standard for the detection and therapeutic decision making regarding ICA.[3,4] However, DSA is invasive and costly with 0.5% risk of permanent neurologic complications.[5]

Rapid evaluation of ICA by technically advanced and minimally invasive cross sectional imaging such as multi detector computed tomography angiography (CTA) and magnetic resonance angiography (MRA) has changed diagnostic approach to ICA evaluation.[6] CTA has sensitivity and specificity of 88% and 89%, respectively.[7] Due to ongoing development of the cross sectional imaging, DSA is gradually replaced by MDCTA and MRA in diagnosis and follow up of ICA. MDCTA is valuable tool for detection of ICA in acute setting of SAH and for therapeutic planning without an additional diagnostic DSA.[8,9] Its three dimensional capability and post processing help in assessing morphology of aneurysms, its relationship with parent vessels and finding suitable working projection. On the other hand, MRA has average sensitivity and specificity of 87 and 95%, respectively,[2] but it is limited due to long

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examination time, increased cost, low spatial resolution compared with DSA and susceptibility to motion artifact.[10] So, MDCTA alone is considered a valuable tool for the diagnosis, management and follow up of patients with ICA.

We reviewed the files of the patients diagnosed to have ICA at our centre with the objective of detecting the role of CTA in diagnosis & management of ICA along with short term follow up.

Methods

This is a case series of patients who undergone CTA with clinical suspicion of aneurysm between 2006-2009 at our diagnostic radiology centre, and included those with the diagnosis of intracranial aneurysms. Patients with missing records or lost to follow up were excluded. Indications were subarachnoid hemorrhage, chronic headache, 3rd cranial nerve palsy, hemi paresis and hemiplegia.

CTA was performed on Toshiba aquilion 64 slice MDCT machine. Unenhanced CT scan of range extending from craniovertebral junction to vertex parallel to orbito meatal line was performed at Scan parameters of rotator time 0.5sec/rotation, reconstruction interval 0.3mm, 120Kv/260mAs, HP 41.0 and acquisition time of 7 sec. Then 80 ml of contrast media iopamiro was injected intravenous at 3.5 ml/sec by using power injector via canullae in antecubital veins. A bolus tracking method was used to achieve optimal synchronization of contrast medium distribution with scanning. Region of interest(ROI) was placed within internal carotid arteries and spiral scan was automatically started as threshold of 80 HU(housten unit) is achieved. Source images were transferred to work station vitrea 3.9 for reformatting. Initial useful review of axial images was considered vital. Two dimensional maximum intensity projection (MIP) views and three dimensional MIP volume rendered reconstructions were reformatted from raw images.

The presence of an aneurysm, size, number, morphology, its parent and feeding vessel with collateral circulation from the circle of Willis were determined by the expert radiologists with >10 years experience. Associated findings i.e. hemorrhage & spasm were also noted. All the patients were then followed up for management, any other intervention & mortality.

Data was entered and analyzed in SPSS11.5. Continuous variables were analyzed as means with standard deviation. Categorical variables were analyzed as proportions with percentages.

Results

Total 18 patients were found to have intracranial aneurysms on MDCT between years 2006 to 2009; three were excluded due to incomplete records. Mean age ± standard deviation was 45.8±13.8. Six were males (40%) and 9 females (60%). Two patients had co morbid diseases; one had diabetes mellitus & other had ischemic heart disease. Presenting symptoms/ diagnosis of the patients is summarized in (Tab. 1).

Table 1. Clinical characteristics of patients

Symptom/diagnosis	n(%)
Chronic headache	11 (73%)
Subarachnoid hemorrhage	9 (53%)
Vertigo	7 (46%)
Motor Deficit	
Hemi paresis/plegia	4 (26.8%)
Occulomotor nerve palsy	2 (13.3%)

In 15 patients, mean length ± standard deviation (minimum-maximum) of aneurysm was 7.6 ±3.6 (3-12 mm) and width was 6.2±2.5 (2-10 mm). All had single aneurysm. Signs of ruptured aneurysm were found in nine (53%). The Locations & associated findings along with aneurysms are summarized in (Tab. 2). Follow up was done for all the patients. Two patients expired (17.6%) within 6 months of diagnosis, while others were alive with mean follow up time of 7.6 months and majority were being managed medically with anticonvulsants without any further intervention.

Table 2. Locations & associated findings with aneurysms.

Characteristics	n (%)
Locations	
Middle Cerebral Artery	
Left	4 (26.8%)
Right	2 (13.3%)
Posterior Cerebal Artery	
Left	2 (13.3%)
Right	2 (13.3%)
Right Anterior cerebral artery	1 (6.7%)
Internal Carotid Artery	1 (6.7%)
Basilar Artery	2 (13.3%)
Anterior Communicating artery	1 (6.7%)
Associated Findings	
Vascular Spasm	4 (26.8%)
Plague/Thrombosis	4 (26.8%)
Hermatoma	3 (19.1%)
Inchemic infarct	1 (6.7%)

One of the expired patients was 25 years old, presented with headache & right hemiplegia, diagnosed to have SAH and a ruptured 9×7 mm aneurysm was found on MDCTA in posterior cerebral artery(PCA). Other expired patient was 60 years old diabetic male with left hemi paresis & subarachnoid hemorrhage with 6×6mm involving middle cerebral artery(MCA) aneurysm associated with intracerebral hematoma.

Discussion

In our case series of 15 patients, mean age ± standard deviation was 45.8±13.8. Six were males (40%) and 9 females (60%) with mean length ± standard deviation of aneurysm was 7.6 ±3.6 (3-12 mm) and width of 6.2±2.5 (2-10 mm). All had single aneurysm. Signs of ruptured aneurysm were found in nine (53%) and two expired (17.9%).

This is single centre study with short term follow up of patients. All live patients were being managed based on the MDCTA findings and no further intervention was done till the follow up time. As 90% of the ICAs are detected when they rupture producing SAH, an ideal radiological diagnostic tool is required for this medical emergency, which should be accurate, easy, noninvasive and readily available and provide pragmatic information regarding appropriate management. Due to all these advantages, MDCTA is replacing DSA.[8,9] Previous studies have also shown high sensitivity and specificity of CTA in evaluation of ICA of at least up to 5 mm.There is some variation in the minimum size picked up by CTA in previous studies. Yomamoto et al and Aoki et al also shown that aneurysms of ≥3 mm are picked up by CTA.[11,12] Eisen et al reported the detection of up to 2mm size ICA.[7,12] Our results correspond to Eisen findings, as the minimum size of ICA detected in our case series was 2×3 mm. In the literature, 85% of aneurysms are reported to be found at polygon of Willis and anterior cerebral artery is reported to be the most common site of all. However, in our case series middle cerebral artery was most frequent site followed by posterior cerebral artery. Schwartz et al reported that SAH might obscure the ICA,[13] but we found that by using increased load of contrast medium vessels became much denser than surrounding blood. Young et al also strongly recommend CTA for evaluation of SAH,[14] when DSA is least helpful. valliblanca et al demonstrated that CTA was able to triage patients between endovascular and neurosurgical treatment options in a significant number of cases.[15] Nael et al and Hoh et al stated that correct management decision was made for 96% of patients based on CTA alone.[6,16] In our case series, all patients were being managed for ICA based on MDCTA and no further intervention i.e. MRA & DSA was done.

Conclusion

Our case series supports the use of MDCTA alone for the effective evaluation of ICA of = 2 mm without any further investigations.

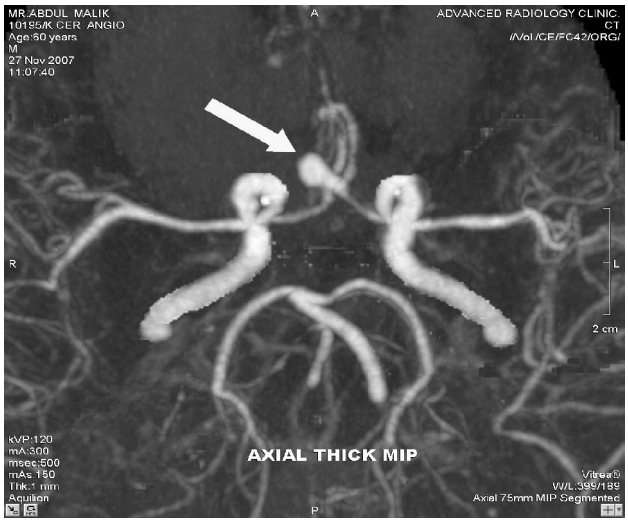

Figure 1A. 60years, male, ACA aneurysm

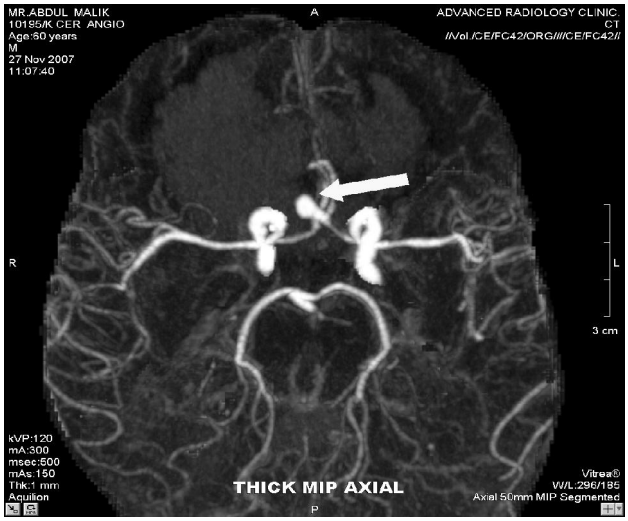

Figure 1B. Associated bilateral frontal lobe hematoma

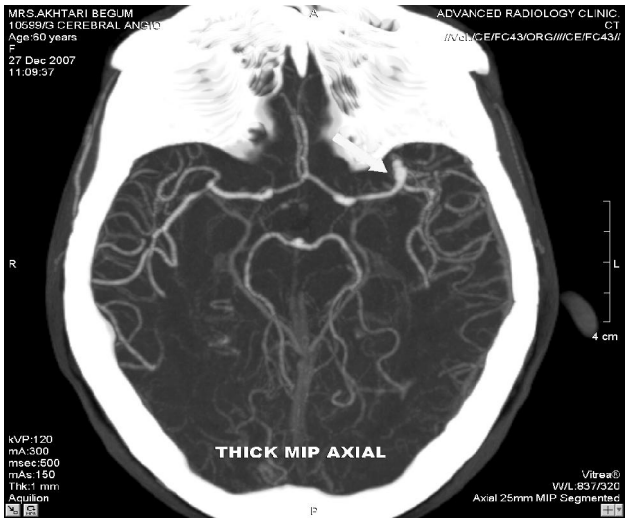

Figure 2. 60years, female, Left MCA aneurysm, with spasm of MCA at its origin and distal to aneurysm

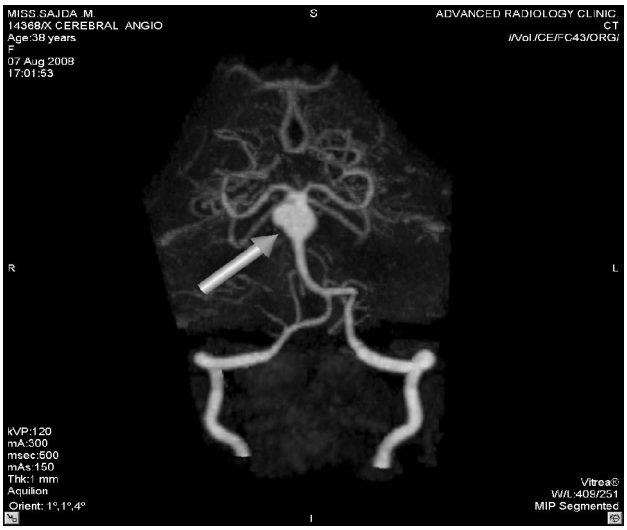

Figure 3. 38 years, female- basilar artery aneurysm

Figure 4. 40 years, female - bilobed Right MCA aneurysm

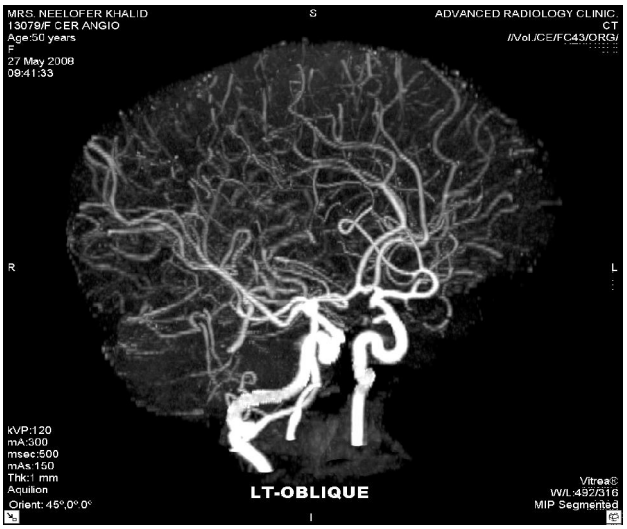

Figure 5. 50 years, Female- Left distal internal carotid artery aneurysm

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