Evaluation of Subarachnoid Haemorrhage with CT Cerebral Angiogram

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ABSTRACT

Introduction: The non-invasive advantage of CT angiography makes it a preferred first line modality to analyse subarachnoid haemorrhage. Study aimed to evaluate spontaneous subarachnoid haemorrhage with CT angiography as the primary imaging modality . The exact location, distribution and the number of aneurysms and arteriovenous malformations and the distal vessel status are assessed for their role in management.
Material and Methods: About 55 patients with subarachnoid haemorrhage referred to CT angiogram over a period of one year. Informed consent was obtained from patients. These patients were evaluated with 64 slice Brillance version of Phillips.
Results: No significant sex predilection is noted in the prevelance of aneurysms. Saccular aneurysms are more common in both sexes. Males have a predilection for anterior circulation, whereas females have equal distribution in anterior and posterior circulation
Conclusion: CT angiogram because of its inherent non-invasiveness, reliability, fastness, is very useful in making quick decisions for management. It is a frontline modality and plays a major role in subarachnoid haemorrhage analysis.

Keywords: anuerysm, subarachnoid haemorhage, saccular aneurysm, fusiform aneurysm

INTRODUCTION

The non-invasive advantage of CT angiography makes it a preferred first line modality to analyse subarachnoid haemorrhage. This modality apart from documenting the cause of subarachnoid haemorrhage plays a vital role in decisions of management.
Sudden onset of intense headache is the most common symptom of subarachnoid haemorrhage. Computed tomography is the primary imaging tool to confirm subarachnoid haemorrhage. The cause of haemorrhage has to be identified for treatment. The risk of acquiring a permanent nuerological damage is below 0.1% in invasive cerebral angiography.[1] Eventhough the risk is low, non-invasive imaging like CTA is preferable. The reported sensitivity of CT angiography lies in the range of 80%–97% depending on the size and location of an aneurysm.[2]
The aim of the study is to evaluate the cause and effect of spontaneous subarachnoid haemorrhage with CT angiography as the primary imaging modality. The exact location, distribution and the number of aneurysms and arteriovenous malformations and the distal vessel status are assessed for their role in management

MATERIALS AND METHODS

About 55 patients with subarachnoid haemorrhage including 30 males and 25 females referred to CT angiogram over a period of one year were assessed in Barnard institute of Radiology, Madras Medical college for a time period of one year. Ethical clearance was obtained. Informed consent was obtained from patients. These patients were evaluated with 64 slice Brillance version of Phillips. Initially plain CT study was obtained to assess other co-morbidities and followed by arterial, venous acquisition phases.
The spatial resolution of the used 64 slice CT is 0.5 mm and temporal resolution is 200msec.
Scanogram and plain serial axial sections of the neck and brain were done initially. Then the dynamic cerebral arterial study and venous phase with 100ml of non-ionic contrast using pressure injector was done.
The plain axial cuts were carefully evaluated for parenchymal changes (haemorrhage, infarct, mass) and vascular changes like calcification. The dynamic arterial phase was carefully observed for filling defects, anuerysms in bilateral internal carotid, vertebral arteries, circle of Willis and its branches. The venous phase was observed for filling defects in deep veins to rule out thrombosis.
Multiplanar reconstruction and 3D images were also analysed for undetectable aneurysms in the routine axial images.

Inclusion criteria: All patients of both sexes of all ages[2-80 years] with spontaneous subarachnoid haemorrhage.

Exclusion criteria: Patients with trauma and Post-operative causes.

STATISTICAL ANALYSIS

Microsoft office 2007 was used statistical analysis. Descriptive statistics like mean and percentages were used for interpretation of results.

RESULTS

Age distribution in subarachnoid haemorrhage: In the age group 0-10 years, one male child was having subarachnoid haemorrhage, 11-20 years- 2 males and two females, 31-40 yrs – 2 males and 1female, 41-50 years 10 males and 1 female, 51-60 years -6 males and 6 females, 61-70 years- 5 males and 3 females, 71-80 years 2 males and 4 females.

Causes of subarachnoid haemorrhage: 32 patients were having aneurysms, 1 was having AVM, 1 had Takayasu's arteritis, 1 was having superior sinus thrombosis. No documented cause was seen in 20 patients

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How to cite this article: K.P. Kasi Visalakshi, G.Vijayalakshmi, K. Malathy. Evaluation of subarachnoid haemorrhage with CT cerebral angiogram. International Journal of Contemporary Medical Research 2016;3(11):3248-3250.

Number of aneurysms: 14 male and 13 female patients had single aneurysm, 3 males and 1 female had 2 anuerysms and one female patient had 3 anuerysms.

Age distribution of aneurysms: 26 patients were in 41-60 age group, 11 were in 61-70 age group, 4 in 21-40 age group and 3 were in 1- 20 year age group

Size of aneurysm: 13 aneurysms had fundus of the size 4-6 mm, 8 were in 6-8 mm isze, 6 were in 2-4 mm size., 4 in 8-10 mm size, 5 in 10-12 mm size, one each in 12-14 mm and 14-16 mm size

Size of the neck: Most of the cases had neck size between 1-3mm.

Shape of aneurysms: 27 anuerysms were saccular and 5 were fusiform

DISCUSSION

Our study includes a total of 55 patients including 30 males and 25 females. Most of the subarachnoid haemorhages occur in the 40-60 age group both in males and females.

The most common cause of subarachoid haemorrhage is aneurysms (32 cases), arteriovenous malformation (1 case), Takayasu's arteritis (1 case), superior sinus thrombosis (1 case) and in 20 cases no cause could be identified.

Of the 38 cases of aneurysms, 20 were in male and 18 were in female patients. 66 % of the males with SAH showed aneurysms, 67 % of the females with SAH showed aneurysms.

Multiple aneurysms occurred in 5 patients, 3 male and 2 female. Two aneurysms were seen in anterior communicating artery in a 40 year old male. In another 18 year old male patient, one aneurysm was seen in right middle cerebral artery and other in cortical branch of right middle cerebral artery. In a patient of 67 years, one was in right MCA and other in left MCA. A 62 old female had aneurysm in right and left MCA. A 44 yr old female had 3 anuerysms, two in left vertebral and 1 in right vertebral artery (Figure 1, Table-1).

Of the 26 anuerysms in male patients, 24 had aneurysms in anterior circulation and 2 had aneurysms in posterior circulation. Of the 15 anuerysms in female patients, 6 were in anterior circulation and 9 in posterior circulation. Males had predilection for aneurysms in anterior circulation whereas in females it is the posterior circulation.

The aneurysms were mostly saccular (Figure 2). Of the 32 cases, 28 patients had saccular aneurysms, two had fusiform aneurysm and one patient had both saccular and fusiform anuerysms. Both the fusiform aneurysm occurred in basilar artery tip, one in a male and other in a female, who were 50 years old, which could be attributed to atherosclerotic changes. In a female with multiple aneurysms, 2 were fusiform and one was saccular in vertebral arteries

Of the 38 anuerysms in 32 patients, 13 were seen in middle cerebral artery (34%), 9 in anterior cerebral artery (23%) (fig 3), 8 in anterior communicating artery (21%), 5 in basilar artery tip (13%), 2 in posterior cerebral artery (5%) and 4 in vertebral artery (10%) revealing that the vertebral arteries rarely show aneurysms.

The fundus measured 4-6 mm in 40% of the cases, 6-8 mm in

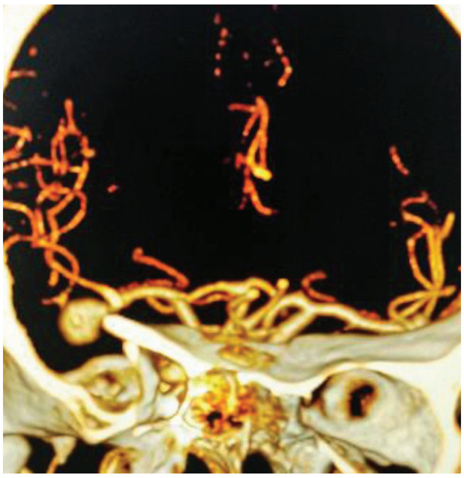

Figure-1: Right vertebral artery dumb-bell shaped fusiform aneurysm and left saccular anuerysm

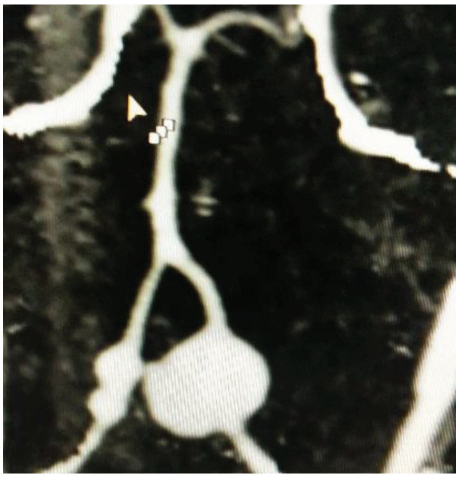

Figure-2: Right middle cerebral artery saccular anuerysm

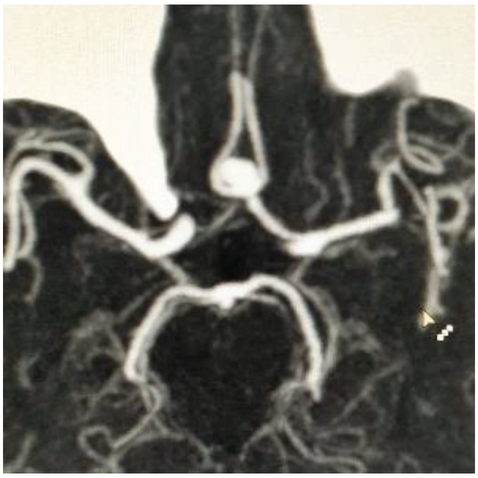

Figure-3: Saccular anterior communicating artery aneurysm

	ACA	ACom	MCA	PCom	PCA	BasilarA.	VertebralA.	ICA
Male	6	6	6	nil	nil	2	nil	1
Female	2	2	5	nil	2	2	4	Nil

Table-1: Location of anuerysms

23% of the cases, 2-4 mm in 17% of the cases with average size ranging 5-7mm. The direction of the fundus is best evaluated by 3D techniques.

The neck measured 2-3 mm in 39 % of the cases, 1-2 mm in 29% of the cases, thus helping to pick up suitable cases for coiling.

The subarachnoid haemorrhage in the plain CT looked hyperdense in the acute phases filling up the hypodense CSF filled spaces with CT attenuation values of 45 to 75 HU and showed intraventrattenuicular extension in subacute cases with layering and CT attenuation values of 25- 35 HU. The plain CT apart from showing the above features showed resolved SAH with normal attenuation of subarachnoid spaces.

CT angiography is an accurate first line modality for evaluating spontaneous subarachnoid haemorrhage and finding aneurysms. Only about 2% of the aneurysms can be missed in CT angiography.[3] It has been attributed to beam hardening artifacts in posterior fossa aneurysms, patient movement, arterial fenestrations, perianuerysmal blood and intraanuerysmal thrombus, suboptimal arterial enhancement and peripheral location of aneurysms[3]

Most intracranial aneurysms occur at predictable sites around the circle of Willis.[4] No gender difference noted in the prevelance of anuerysms in our study. Gender differences were noted in the location of anuerysms, with the anterior circulation more commonly involved in males and posterior circulation was commonly involved in females. In another study, PCom is identified as the most common site of rupture in females.[5]

The saccular type accounts for 90% of intracranial aneurysms.[6] In our study also, it constituted about 87.5% (Figures 1 and 3). When there is collagen deficiency in the internal elastic lamina and breakdown of the tunica media, an outpouching protrudes through the defect in the internal elastic lamina and tunica media to produce the aneurysmal sac.[7,8] Three-dimensional information on the aneurysm that caused the bleeding can be obtained within a few minutes and used for therapy planning.[9] Supraclinoid aneurysms can be well visualized by applying MIP or volume rendering.[10] Post treatment evaluation of patients treated with metallic therapeutic devices is difficult due to metallic nature of the devices. MRA and catheter angiography are helpful for these patients.[11]

CONCLUSION

CT angiogram because of its inherent non-invasiveness, reliability, fast and very useful in making quick decisions for management will come to the frontline modality and will play a major role in subarachnoid haemorrhage analysis. This modality avoids the significant complication risks associated with catheter angiography. The easy availability of this imaging study will definitely be a boon to subarachnoid haemorrhage patients.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 15-10-2016; **Published online**: 29-11-2016