ORIGINAL RESEARCH PAPER

Radiology

CEREBRAL COMPUTERIZED TOMOGRAPHY ANGIOGRAPHY (CTA) IN THE DIAGNOSIS OF ACUTE SUBARACHNOID HAEMORRHAGE.

KEYWORDS: Cerebral CTA, subarachnoid haemorrhage, aneurysms.

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ABSTRACT

Purpose: To evaluate the usefulness of CT angiography (CTA) in the detection of cause of acute subarachnoid haemorrhage (SAH). Methodology: Prospective observational study was performed in 100 patients with non traumatic subarachnoid haemorrhage. A helical contrast enhanced CTA was performed to evaluate the cause of subarachnoid haemorrhage.CTA data were reconstructed with maximum intensity projection and were evaluated to obtain diagnostic information. History of hypertension was obtained for all the patients. Results: In 58 patients out of 100, CTA diagnosed aneurysms ranging from 3 mm to 25 mm in size. 4 patients were diagnosed to have multiple aneurysms. 6 patients had arterio-venous malformation, 4 had venous sinus thrombosis and 2 patients were diagnosed to have Moyamoya disease as a cause of subarachnoid haemorrhage. In 30 patients no vascular cause for acute subarachnoid haemorrhage was identified. In case of aneurysm, the size and neck of aneurysm was measured along with evaluation of direction of aneurysm. Aneurysm was the commonest cause of subarachnoid haemorrhage. Conclusion: CT Angiography proved to be helpful in diagnosing the vascular causes of acute non traumatic subarachnoid haemorrhage and in demonstrating the topographic anatomy of cerebral aneurysm and surrounding structures.

AIM

- To evaluate the usefulness of CT angiography (CTA) in the detection of cause of acute subarachnoid haemorrhage (SAH).
- To map the cerebral aneurysms completely being commonest cause of acute subarachnoid haemorrhage with the help of cerebral CT Angiography.

INTRODUCTION

The incidence of subarachnoid haemorrhage has been estimated to be about 6-8 per 1,00,000 person-years. (1)

Sudden, severe explosive headache, vomiting, altered sensorium are common clinical presentations. Usually the headache is described as worst headache of the life. The usual age of presentation is 55-60 years. (2)

With the advent of multislice MDCT, CT angiography has emerged as the alternative to the invasive cerebral digital subtraction angiography (DSA). It is still to be universally accepted as a standard first line diagnostic test for evaluation of subarachnoid haemorrhage (3). The advantages of three-dimensional representations of the arteries and their relationship to the surrounding structures are well documented. Additionally the ability to rotate the 3D images into the identical projection encountered by the surgeon has tremendous advantages. Also, CTA has the ability to characterize the relevant preoperative surgical anatomy such as aneurismal neck morphology, apical teats, calcification, thrombosis, parent and feeding vessels, diagnosing additional small aneurysms and collateral circulation at the circle of Willis (4). Now with 16, 32 and 64/128 slice spiral scanners, it is feasible to obtain pure arterial phase images without any venous contamination.

We present a study of 100 patients with acute subarachnoid haemorrhage evaluated by multidetector CT angiography.

MATERIAL AND METHODS

A prospective observational study of 100 patients was done at our institute over a period of July 2015 to February 2017 to evaluate the cause of subarachnoid haemorrhage in non traumatic condition.

History of hypertension was obtained for all the patients.

All the patients had undergone non contrast computed tomography of brain and had being diagnosed as having subarachnoid haemorrhage.

No gender bias was followed and study included all the age group patients.

All patient underwent CT angiography after requisite pre procedure criteria was fulfilled.

Anaesthesia was given in the required patient to get a good quality data to obtain good reconstruction.

Inclusion criteria:

- Patients diagnosed as having non traumatic spontaneous subarachnoid haemorrhage on Non contrast CT brain.

Exclusion criteria:

- Patients having traumatic subarachnoid haemorrhage.
- Post clipping patients.

Ct angiography was done on Siemens Somaton Sensation 64 slice CT scanner machine and protocols we followed were:

1.0 mm section thickness, 0.5 mm section interval, Pitch of 3, 120 kVp and 240 mAs, 14 cm field of view, scanning time was 10-15 seconds. The scanning volume included from 1st cervical vertebra to a point 1 cm above the lateral ventricles.

Approximately 60-80 ml of non ionic low osmolar iodinated contrast material was administered intravenously with a power injector at a rate of 4-5 ml/sec via 18-gauge catheter positioned in a peripheral vein after a negative test dose of contrast. Contrast material was injected and scan was initiated at a fixed delay of 16 seconds.

The source images were reconstructed directly into 3 dimensional formats and recorded in maximum intensity projection (MIP), shaded surface display (SSD) and volume rendered images.

All the images obtained in axial scan were thoroughly evaluated to look for the cause of subarachnoid haemorrhage. Images in coronal and sagittal planes with maximum intensity projection were evaluated to get details of aneurysm site, size, direction and neck.

RESULTS

An observational study of 100 cases included 48 females and 52 male patients. The results of our study are depicted in following tables.

Table1. Diagnosis of cause of subarachnoid haemorrhage.

Diagnosis	No of patients	Percentage
Aneurysm	58	58%
Arterio-venous malformation	6	6%
Venous sinus thrombosis	4	4%
Moyamoya disease	2	2%
No cause or unknown cause	30	30%

Table2. Location wise distribution of aneurysms.

Artery involved	No of patients	Percentage
Internal carotid	16	27.5%
Middle cerebral	14	24%
Anterior cerebral	4	7%
Anterior communicating	18	31%
Basilar	2	3.5%
Cortical branch of middle cerebral	2	3.5%
Superior cerebellar	2	3.5%

Table3. Presentation of aneurysmal subarachnoid haemorrhage.

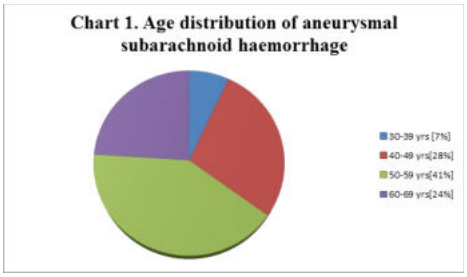
Distribution of subarachnoid haemorrhage	No of patients diagnosed to have aneurysm	Percentage
Focal	16	16%
Diffuse	42	42%

Table4. Size of neck of aneurysm.

Size of neck	No of patients	Percentage
Small neck(<4mm)	42	72%
Wide neck(>4mm)	16	28%

Table5. Direction of aneurysm.

Direction of aneurysm	No of patients	Percentage
Anterior	6	10
Antero-inferior	20	34
Antero-superior	4	7%
Posterior	4	7%
Postero-superior	16	28%
Postero-inferior	8	14%



DISCUSSION

The causes of spontaneous subarachnoid haemorrhage are:

- Ruptured intracranial aneurysms (75-80%).
- Arteriovenous malformations (5%).
- Cryptic vascular malformations (5-10%).
- Vasculitis.
- Blood dyscrasias.
- Primary and metastatic brain tumors (<2%).
- Eclampsia (<2%).
- Anticoagulant therapy.
- Unknown etiology (7-10%).(5)

Rupture of intracranial aneurysm is the most common cause of subarachnoid haemorrhage. 90-95% of aneurysms are found in carotid circulation. 5-15% in vertebro-basilar circulation and 15-20% aneurysms are multiple. (5)

In our study we found that most common cause of non traumatic acute subarachnoid haemorrhage is aneurysm of circle of Willis. 58% patients were diagnosed to have aneurysm. Out of 58% of patients 16% were presented with focal subarachnoid haemorrhage and 42 % with diffuse subarachnoid haemorrhage. 72% of the patients were having small neck aneurysm, measuring <4 mm neck size, while 28% were having wide neck aneurysm with neck measuring > 4mm. Most common direction of aneurysm is antero- inferior in 45% of patients, followed by postero-superior in 38% and anterior and posterior in 10% and 7% of patients respectively.

Endovascular coiling and surgical clipping occlusion of small neck aneurysm and aneurysms directed right angle to parent artery have favourable outcome , while aneurysm with wide neck and complex anatomy have less favourable results with endovascular procedure and coiling and carries a risk of parent vessel occlusion. So it is done with placement of stent in parent artery. In that case open surgery and clipping is the method of choice for occlusion of aneurysm. (6)

Common locations are anterior communicating artery (30-35%), posterior communicating artery (30-35%), the middle cerebral artery bifurcation (20%), basilar top (5%) and PICA(5%)(7). In our study also 31 % aneurysms were seen in anterior communicating artery, 27.5% in internal carotid artery and 21% in middle cerebral artery, 7% in anterior cerebral artery and 3.5% in other arteries like basilar, superior cerebellar and cortical branches.

In our study 41 % of the patients were diagnosed to aneurysmal subarachnoid haemorrhage, were in the age group of 50-59 years. 6% of patients were having arterio –venous malformation. The site of arterio-venous malformation was frontal region in 4% and cerebellar region in 2%. CT angiography excellently demonstrates the tightly packed masses of enlarged feeding arteries, the nidus and tortuous draining vein. The most common age of presentation of rupture of arterio-venous malformation is 20-40 years.

4% patients were diagnosed having venous sinus thrombosis, the site of thrombosis was transverse sinus in 2% of patients and cavernous sinus in 2%.These patients were having intra parenchymal hematoma along with subarachnoid haemorrhage . 2% of patients were diagnosed to have Moyamoya disease. Moyamoya disease (MMD) is an idiopathic progressive arteriopathy characterised by stenosis of the distal supraclinoid internal carotid arteries and formation of an abnormal vascular network at the base of the brain. It presents with an intra cranial haemorrhage due to rupture of fragile Moyamoya collateral vessels.
Out of 30 % patients, in which no vascular cause of subarachnoid haemorrhage was identified, 20% patients were hypertensive, 2% patients were diagnosed to have dengue fever and in remaining 8% of the patients, no other cause was identified.

Study conducted by Lenhart M, et al. Acta Radiol.1997 on cerebral CT angiography in diagnosis of acute subarachnoid haemorrhage showed that 39 (73.5%) patients out of 53 were diagnosed to

have subarachnoid haemorrhage due to rupture of cerebral aneurysm of size ranging from 3 mm to 16 mm and in 14(26.5%) patients , no vascular cause was identified. In comparison to this study, in our study 58 (58%) were diagnosed to have aneurysm of a size ranging from 3 mm to 25 mm as a most common cause of subarachnoid haemorrhage and in 30(30%) patients no vascular cause was identified.
In a recent study comparing 64 slice CTA with DSA and 3DRA found sensitivity of 64 slice CTA for aneurysms >4mm was 100% and for <4 mm was 92.3%. (8)

Pitfalls of CT angiography include lack of visibility of small arteries ,difficulty in differentiating the infundibular dilatation at the origin of an artery from an aneurysm , the kissing vessel artefact ,demonstration of venous structures that can simulate aneurysms, inability to identify thrombosis and calcification on three dimensional images and beam hardening artefact produced by aneurysms clips.(9)

CONCLUSION

Cerebral CT angiography is more sensitive and specific in diagnosis of cause of subarachnoid haemorrhage. Intra cranial aneurysms are the most common cause of acute subarachnoid haemorrhage, which mostly involves anterior circulation in circle of Willis .The most common age of presentation of acute subarachnoid haemorrhage is 50-59 years. Size and direction of neck of aneurysm are important in determining the further plan of management and predicting prognosis in the patient. The CT angiography is proved to be helpful in demonstrating the topographic anatomy of cerebral aneurysms like site, size, neck and direction of aneurysm and relations with surrounding structures. CT angiography is gold standard in demonstrating the nidus, feeding artery and draining vein in case of arterio-venous malformations.

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