IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 11 Ser. 4 (November. 2024), PP 59-63
www.iosrjournals.org

"Correlative Study Of Plane Ct Brain And Ct Cerebral Angiography In Cases Of Spontaneous Sub Arachnoid Hemorrhage"

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Date of Submission: 03-11-2024 Date of Acceptance: 13-11-2024

I. Introduction And Need For The Study:

Plane CT brain is considered as the first investigation of choice for the patients presenting with acute onset headache, with sensitivity of 95% for detection of Subarachnoid hemorrhage(SAH). SAH appears as areas of hyper densities in the sulci and fissures and is easily diagnosed on unenhanced CT.[1,2]CT Angiography has vital role in diagnosing the etiology of the SAH by finding the aneurysmal or any other vascular abnormality and is considered as gold standard imaging for the same.[3,4,5]Correlation between pattern of distribution of SAH in plane CT with the abnormal intracranial vessel on CT Angiogram explains the etiology and substantiates the CT Angiography finding. Hence, there is need for correlation of plane CT brain findings with CT Cerebral Angiography findings in cases of Spontaneous SAH.

II. Aim And Objectives

AIM: To correlate plane CT brain findings and CT cerebral Angiography findings in cases of Spontaneous Subarachnoid hemorrhage.

OBJECTIVES: To evaluate role of CT cerebral Angiography in diagnosing the cause of Spontaneous SAH and to compare pattern of distribution of SAH in plane CT with the territory of abnormal intracranial artery on CT Angiogram and correlate the same.

III. Materials And Methods:

- 100 cases presented with acute headache underwent CT Brain and CT Angiography in 128 slice CT machine(Manufacturer-GE Hangwei Medical Systems Co.Ltd, China,Model-Revolution EVO, Equipment ID-G-XL-104324) at Father Muller medical college, Mangalore. The CT images were retrospectively collected from Picture Archiving and Communication Systems(PACS).The location and the patterns of distribution of SAH on plain CT (perimencencephalic, convexal and diffuse) were noted. CT cerebral Angiography was performed to look for aneurysms or any other vascular etiology. The arterial locations examined were- bilateral Internal carotid artery, bilateral M1 and M2 segment of Middle cerebral artery, A1 and A2 segments of Anterior cerebral artery, Anterior and Posterior communicating arteries, Inferior cerebellar arteries and Basilar artery. The distribution of pattern of SAH on plane CT was compared and correlated with the territory of abnormal arteries on CT cerebral Angiography.
- **Criteria followed to correlate predominant location of sah on plane ct with most likely artery to be involved in ct angiography[1]**:The SAH distribution and the existence of any hematoma aid in identifying the aneurysm causing the bleeding. An anterior communicating artery aneurysm is suggested by an interhemispheric hematoma, a SAH mostly in the anterior region of the interhemispheric cisterna and the suprasellar cisternae, and/or both.An ipsilateral middle cerebral artery aneurysm should be investigated in response to a temporopolar hemorrhage or a SAH that is mostly located in the motor cortex sulcus. Rupture of an end carotid aneurysm may result in an isolated lenticular hematoma. A ruptured postero-inferior cerebellar

artery (PICA) aneurysm is suggested by a SAH that is primarily located in the basal cisternae adjacent to the cerebel lopontine angle cisternae and has an asymmetrical distribution. A posterior carotid aneurysm should be investigated in the event of an acute subdural hemorrhage without a history of injury.

❄Plane CT was also evaluated to look for complications of SAH like intraventricular bleed, hydrocephalus, infarcts due to arterial spasm.It was also used for radiological grading of SAH by **modified Fisher scale.(9)** While using the modified Fisher scale, the risk of developing vasospasm progressively increases with each grade. The incidence of symptomatic vasospasm is less then 24% in grade 0 and 1 and considered to have good prognosis while grade 2, 3,4 have higher incidence of symptomatic vasospasm.

Table 1 Modified Fisher's scale, 2001.

Grade	Criteria
0	No subarachnoid hemorrhage (SAH) or ventricular hemorrhage (VH)
1	Minimal SAH, no HV in the 2 lateral ventricles
2	Minimal SAH, HV in the 2 lateral ventricles
3	Large SAH[a], no VH in the 2 lateral ventricles
4	Large SAH[a], VH in the 2 lateral ventricles

VH: ventricular hemorrhage.
[a] SAH completely filling at least one cisterna or fissure.

Case Selection Criteria: Patients with more than 18 years of age and who presented with acute headache were included. Patients with less than 18 years of age,with history of Road Traffic Accidents and with history of intracranial space occupying lesion and cerebrovascular accident were excluded.

IV. Data Analysis And Discussion

Demographic Data Analysis: Among the 100 cases presenting with acute headache warranting the need for CT Brain, majority (86%) aged above 40 years. However, no statistically significant male or female predominance noted.

Plane CT Brain Findings: The statistical analysis of the pattern of distribution of SAH on Plane CT Brain showed the convexal pattern of distribution to be the most common type(45%) with diffuse SAH(20%) being the least common type. 23 cases with headache had no evidence of SAH on plane CT.

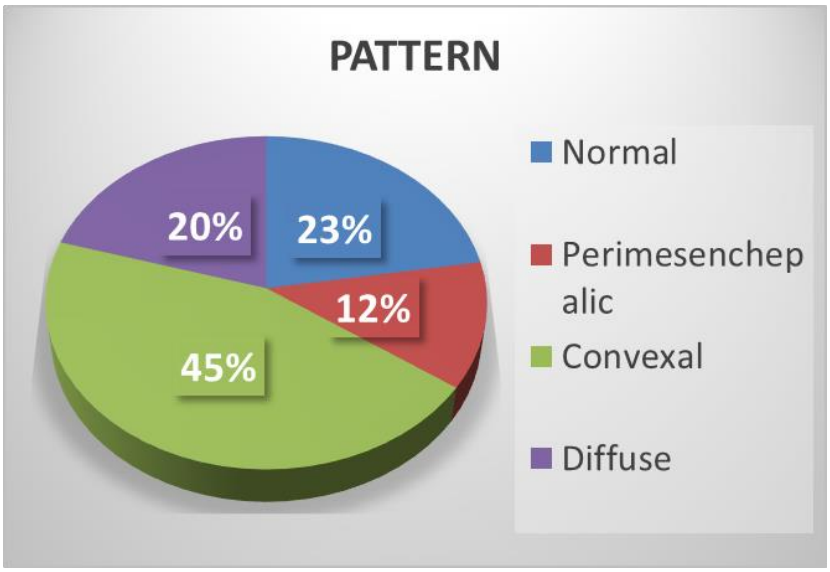


Figure 1: Pie chart showing distribution of SAH on Plane CT Brain, with 23% being normal study, 12% of them showing perimesencephelic distribution of SAH, 45% of them showing convexal distribution of SAH and 20% of them showing diffuse distribution of SAH.

❄Patients were given Modified Fisher's score and 65 % were predicted to have good prognosis(Grade 0 and 1 considered to have good prognosis). The Modified Fisher Scale is useful in predicting the risk of complications and outcomes after SAH, such as the development of cerebral vasospasm, which can cause stroke-like symptoms. It can also help guide treatment decisions, such as the use of prophylactic medications to prevent vasospasm.

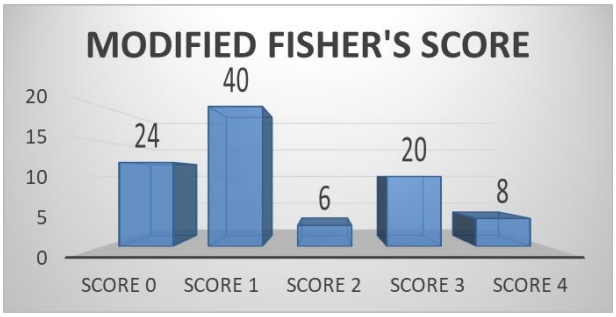


Figure 2: Chart Showing 40 Cases To Be Scored As 1, 24 Cases As 0, Which Represent Good Prognosis. Rest 34 Cases As Score 2,3, And 4 Which Might Represent Poor Prognosis.

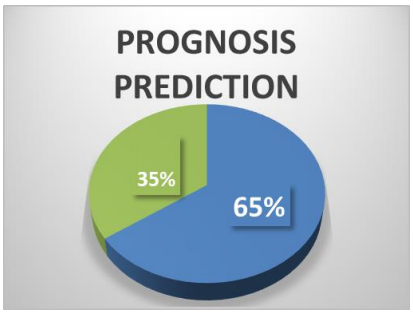


Figure 3: Pie Chart Showing 65% Cases Having Score 1 And 0 Modified Fisher's Score To Have Good Prognosis.

CT Angiogram Findings: Follow up CT Angiogram of the respective cases showed 88% had Aneurysms,4 % had Arterio-Venous malformations and 8% were normal study. As we could detect aneurysms in 88% cases and AVMs in 4% cases, study done by Spitzer C et al. also showed similar results with 85% of non-traumatic SAHs accounting due to aneurysmal rupture and non-aneurysmal causes accounting for 7% of SAH.(6)Studies done by Papke K et al,Taschner CA et al, Westerlaan HE et al showed that CT angiography of the circle of Willis has a sensitivity of 98% to detect intracranial aneurysms, particularly because of its excellent spatial resolution.(3,4,5).However aneurysms less then 3mm in size can be missed and CT Angiography sensitivity reduces to 53%(7).Similarly our study showed 8% of normal CT Angiograms.Study performed by Keedy et al showed that the most frequent intracranial aneurysm is of the anterior communicating artery (35%) while in our study, MCA aneurysm was found to be the most common one .(8)

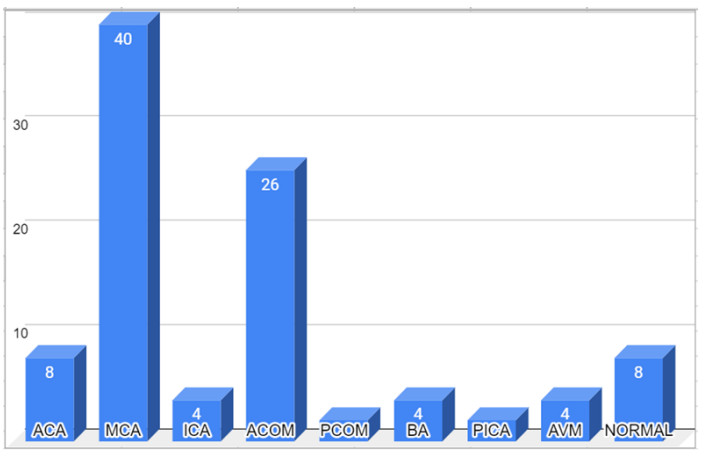


Figure 4: CT Angiogram Of The Respective Cases Showed 88% Had Aneurysms,4 % Had Arterio-Venous Malformations And 8% Were Normal Study

Correlation Of Plane Ct And Ct Angiogram findings: On correlating plane CT and CT cerebral Angiography findings, it was seen that the pattern of distribution on plane CT was corresponding to the arterial territory of the aneurysm detected on CT cerebral Angiography in 78 cases. Few cases of post clipping of the aneurysm were collected and the follow up imaging of post clipping cases showed resolution of SAH. This proves that the CT cerebral Angiography was accurate to diagnose the etiology of Spontaneous SAH.

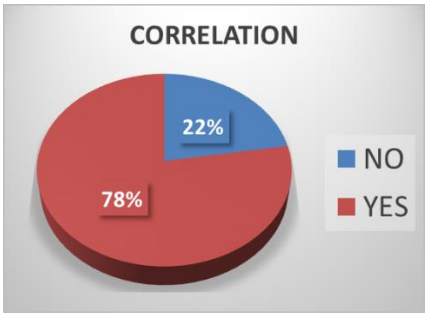
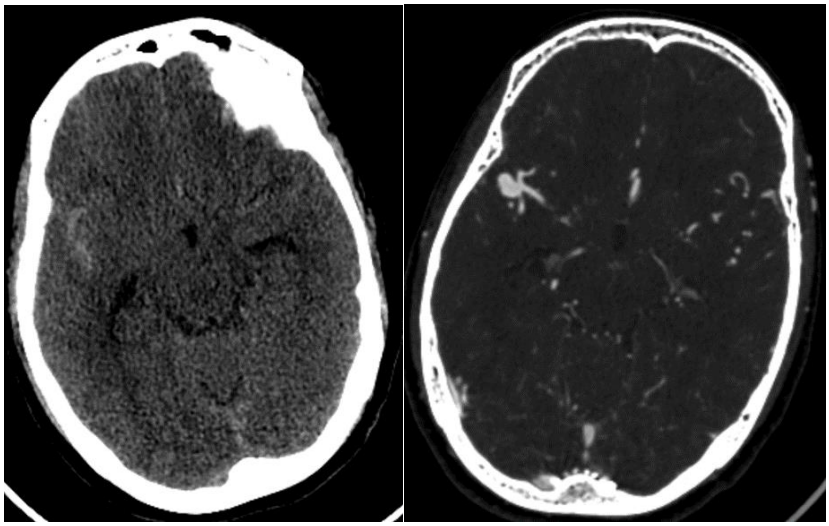


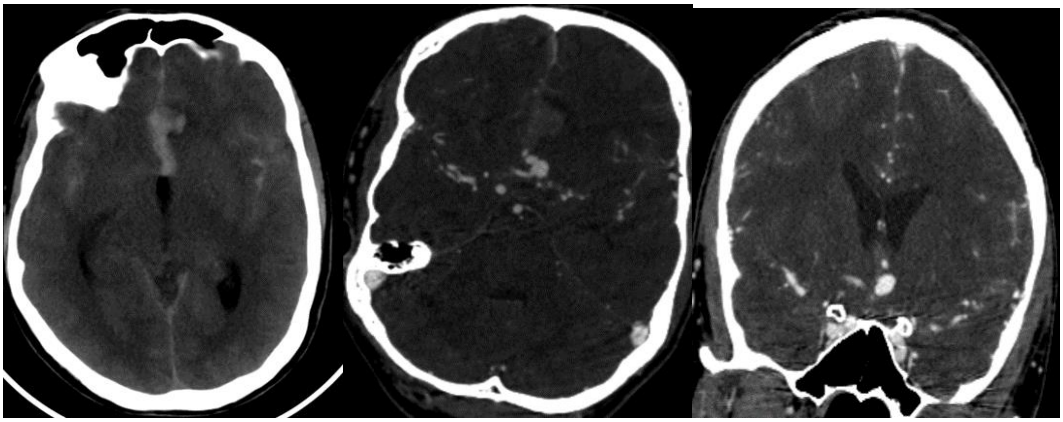
Figure 5: Pie Chart Showing 78 Cases Had Correlative Findings On Plane CT And CT Cerebral Angiography Findings. It Was Seen That The Pattern Of Distribution On Plane CT Was Corresponding To The Arterial Territory Of The Aneurysm Detected On CT Cerebral Angiography.

Representative Cases:
Case 1:



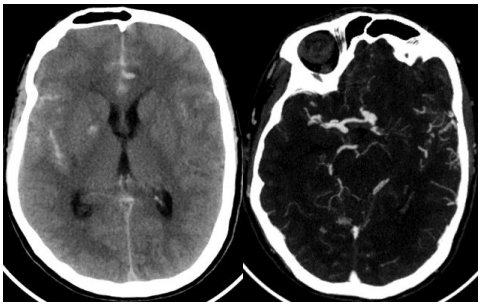
CASE 1: Axial sections of non-contrast CT Brain showing SAH in right perisylvian fissure and basal cisterns. Axial sections of CT Angiography with MIP reconstruction CT Angiography shows a saccular aneurysm(8mm, neck=2mm) at the junction of M1/M2 segment of right MCA, rupture of which could be a possible source of SAH the source of SAH.

Case 2:



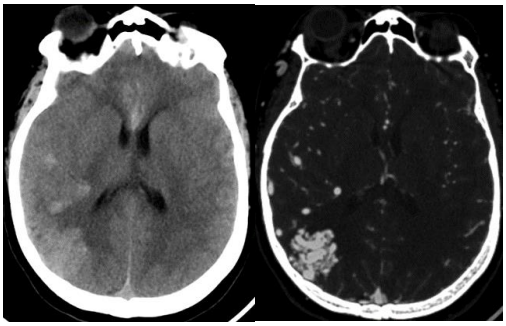
CASE 2: Axial sections of non-contrast CT Brain showing thick SAH in anterior interhemisphere fissure. Axial sections of CT Angiography with MIP reconstruction CT Angiography shows a saccular aneurysm(6.4mm, neck=3.5mm) at the anterior communicating artery, rupture of which could be a possible source of SAH the source of SAH.

Case 3:



CASE 3: Axial sections of non-contrast CT Brain showing thick bilateral diffuse SAH. Axial sections of CT Angiography with MIP reconstruction CT Angiography shows a saccular aneurysm(10.7x4.7mm, neck=4mm) at the anterior communicating artery, which has ruptured and is responsible for the subarachnoid hemorrhage.

Case 4:



CASE 4: Axial sections of non-contrast CT Brain showing thick bilateral diffuse SAH. Axial sections of CT Angiography with MIP reconstruction, shows a arterio-venous malformation with a nidus measuring 2.4x2.4x2.2cm in the right parietal lobe, rupture of which could be a possible source of SAH.

V. Conclusion:

The statistically significant correlation between distribution of pattern of SAH on plane CT and the territory of abnormal arteries on CT cerebral Angiography, proves that CT cerebral Angiography is useful imaging in knowing the anatomy of arterial system and plays important role in diagnosing the etiology of Spontaneous SAH.

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