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Computed Tomography Angiography (CTA) Evaluation of Spontaneous Subarachnoid Hemorrhage

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Abstract

Background: In evaluation of non-traumatic subarachnoid hemorrhage CT angiography (CTA) has 97-98% sensitivity and near 100% specificity. **Objective:** This study was conducted to evaluate the CTA findings of CT positive non traumatic subarachnoid hemorrhage. **Methodology:** This is an observational cross sectional study performed in Neurology department of National Institute of Neurosciences and Hospital, Dhaka over one year period (January 2019 to December 2019). Total 87 CT positive subarachnoid hemorrhage cases were purposively included in this study. All CT positive patients underwent CTA of Cerebral vessels for further evaluation. The angiography were evaluated by competent neuro-radiologists blinded about the study. **Result:** Among 87 patients, 40.2% were male and 59.8% were female. The average age was 53.33±11.1 years. Among the studied patient the source of bleeding was found 78.16% aneurysmal and 21.84% non-aneurysmal. 85.30% patients had single aneurysm and 14.70% had multiple aneurysm. The highest number of patient had Acom aneurysm (41.17%) followed by MCA (22.05%), ICA (13.23%), ACA (7.35%) and vertebral artery (1.14%) in order of frequency. Among the multiple aneurysm group most of the patients had combination of Acom, MCA and ICA aneurysm. **Conclusion:** From this study, we can conclude that CTA can be used as the primary diagnostic tool in evaluation of spontaneous SAH. *[Journal of National Institute of Neurosciences Bangladesh, July 2020;6(2):78-81]*

Keywords: Computed Tomography; Computed Tomographic Angiography; Anterior Communicating Artery; Middle Cerebral Artery; Internal Carotid Artery; Anterior Cerebral Artery

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Introduction

Subarachnoid hemorrhage (SAH) accounts for about 5% of all strokes and most devastating event associated with high mortality and morbidity[1-2]. Around 12.0% to 15.0% of people die before reaching hospital or having brain imaging and around 25% do not survive to hospital

discharge[3-4]. The risk of spontaneous SAH is extremely low in children and increases with age, peaking in the 5th and 6th decades. Female are more affected than male[2]. The commonest cause of non-traumatic SAH is rupture of aneurysm (80.0%) and the remaining 20.0% includes perimesencephalic hemorrhages, rupture of cerebral arteriovenous malformations (AVM) and some rare but recognized causes are coagulopathies, drug abuse, pituitary apoplexy and cerebral sinus thrombosis[5]. SAH is suspected in people who present with sudden severe worst ever headache, may be associated with nausea, vomiting, neck pain, seizure and unconsciousness. In most of the cases, diagnosis can be confirmed by urgent non-contrast CT-scan of head. If the CT-scan is suggestive of SAH, patients are immediately resuscitated in the emergency department and urgent admission in stroke care or intensive care unit and referral for neurosurgical opinion is warranted. For etiological diagnosis cerebral CT angiography (CTA), coagulation profile and other relevant investigations like cerebral DSA may also be needed[4,6].

In patients presenting with spontaneous SAH, early diagnosis and detection of the underlying cause is considered important in order to favour the prognosis. Early detection of an underlying ruptured aneurysm and adequate treatment may eliminate the risk of re-bleeding, which is a major mortality factor[7]. Intra-arterial digital subtraction angiography (DSA), is considered as gold standard imaging for depicting the presence of an intracranial aneurysm. However, DSA is an invasive imaging modality, expensive and carries 3.2% risk of complications. Complications of DSA are mostly re-bleeding, stroke with permanent neurological disability (0.14%) and in rare instances death[8-9]. Therefore, the main advancement in imaging modalities for diagnosis of aneurysm is computed tomographic angiography (CTA). It is a non-invasive imaging modality that can substitute cerebral DSA. The decision of surgical clipping or endovascular coiling of ruptured aneurysm can be taken on the basis of CTA and many neurosurgeon proceed to clipping without doing DSA[10]. A systematic review and meta-analysis showed that, compared with Digital subtraction angiography, CT angiography had a pooled sensitivity of 97.0% to 98.0% and specificity near 100%[11]. The objective of this study was to see the computed tomographic angiography findings of CT-scan positive non traumatic spontaneous subarachnoid hemorrhage.

Methodology

This was a cross sectional study which was performed in the Department of Neurology of National Institute of Neurosciences and Hospital, Dhaka, Bangladesh over one year period from January 2019 to December 2019. CT-scan positive subarachnoid hemorrhage cases were purposively included in this study. The clinical status of the patients were categorized according to the World Federation of Neurological Surgeons (WFNS) grading scale and the CT findings were described according to modified Fischer Scale[12-13]. All CT-scan positive patients underwent CTA of Cerebral vessels for further evaluation. The angiography and CT scan were evaluated by competent neuro-radiologists blinded about the study. All patients were investigated for coagulopathy.

Results

A total number of 87 patients with SAH were included in this study. Among them, 35 were males and 52 were females. The male and female ratio was 1:1.48 (Figure I). The mean age with SD of the patients were 53.33±11.1 years.

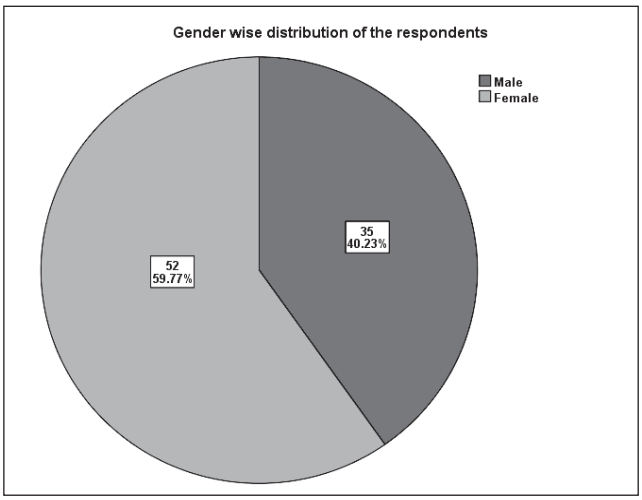

Figure I: Gender distribution of the study population

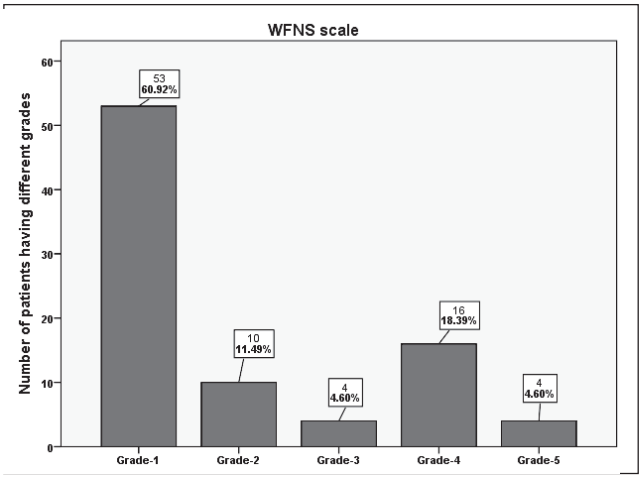

Figure II: WFNS grading of SAH

All patients underwent brain CT scan that established the diagnosis of SAH.The World Federation of Neurological Surgeon (WFNS) grading scale of SAH was 60.9% grade 1, followed by grade 4(18.4%), grade 2(11.5%) and grade 3(4.6%) (Figure II).

Non contrast CT showed that, Modified Fisher scale grade of SAH were Grade 1 in 14.1% patients, grade 2 in 35.3% patients and 24.7% and 25.9% were in grade 3 and 4 respectively (Figure III).

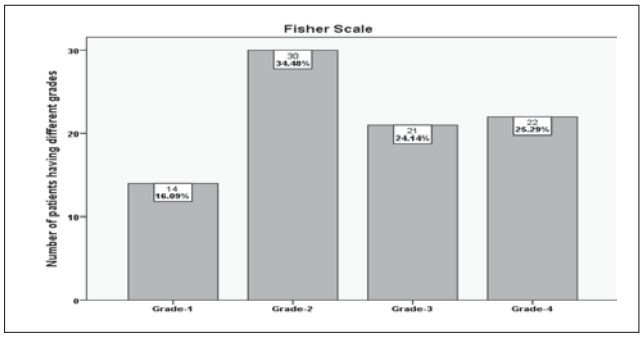

Figure III: Modified Fisher Scale Grading of SAH

Among the studied patients bleeding was aneurysmal in 78.16% and non-aneurysmal in 21.84% (Figure IV).

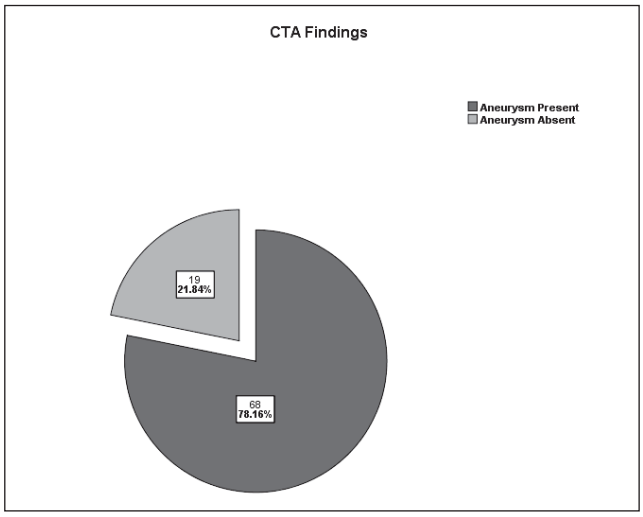

Figure IV: CTA Findings (Presence and absence of Aneurysm)

About 5(5.7%) patients had hemorrhage at perimesencephalic distribution. Multiple aneurysms were found in 14.70% cases. The highest number of patients had Acom aneurysm (41.17%), followed by MCA (22.05%), ICA (13.23%), ACA (7.35%) and vertebral artery (1.14%) in order of frequency (Figure V). Most of the patients with multiple aneurysm had combination of Acom, MCA and ICA aneurysm. One patient had triple aneurysm involving Acom, MCA and Basilar top distribution. Among the non-aneurysmal group only one patient found to have arterio-venous malformation (AVM) at left parieto-temporal region. None of the patients had any bleeding diathesis.

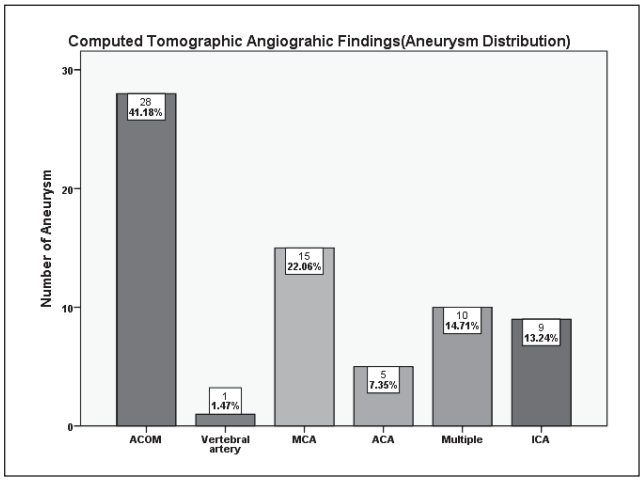

Figure V: Distribution of Aneurysm site

Discussion

Digital subtraction angiography (DSA) with 3D reconstruction has always been considered the gold standard imaging modality for detection of intracranial aneurysms. According to recent literatures, the sensitivity and specificity of multislice helical CTA for detecting aneurysms is approaching that of DSA[11,15,16] Computed tomographic angiography (CTA) is a non-invasive angiographic technique that challenged the need of DSA for diagnosis of intracranial vascular malformations in clinically documented SAH. The utility of spiral CTA has gained increased clinical interest and its non-invasive, rapid and patient friendly nature is complemented by the use of image processing reconstructions. Furthermore, CTA can easily be performed after a non-contrast CT head in cases of SAH, where patients may be critically ill or unstable. This allows for early diagnosis and prompt treatment planning, whether surgical or endovascular is approached.

The age and sex distribution of patients found in this study is consistent with previous studies[6,10]. Non-aneurysmal SAH was found 15.0% in previous studies which is lower than these findings[17]. Further evaluation by cerebral Digital Subtraction Angiography (DSA) is helpful to increase in detecting cerebral aneurysms. In a study, subsequent DSA following a negative CTA shows an aneurysm in 10.0% patients[18]. Higher number

of Acom followed by MCA aneurysm found in this study is also comparable with other studies[19]. The finding of significant number of multiple aneurysm is also consistent with previous studies[19]. Lower number of posterior circulation aneurysm may represent the lack of sensitivity of CTA giving high false negative rate for detecting posterior circulation aneurysm[11, 16].

Conclusion

CTA can identify the maximum aneurysm of patient with spontaneous SAH. Our findings support the use of CTA as the primary diagnostic tool in the evaluation of spontaneous SAH. For posterior circulation aneurysm CTA is not a good option.

References

1. Feigin VL, Lawes CM, Bennett DA, et al. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. Lancet Neurol. 2009;8(4):355–69. Available from: http://dx.doi.org/10.1016/S1474-4422(09)70025-0

2. Van Gijn J, Rinkel GJE. Subarachnoid haemorrhage: Diagnosis, causes and management. Brain. 2001;124(2):249–78

3. Schievink WI, Wijdicks EFM, Parisi JE,et al. Sudden death from aneurysmal subarachnoid hemorrhage. Neurology. 1995;45(5):871–4

4. Connolly ES, Rabinstein AA, Carhuapoma JR, et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage: A guideline for healthcare professionals from the american heart association/american stroke association. Stroke. 2012;43(6): 1711–37

5. Kirkpatrick PJ. Intracranial Aneurysms : What Subarachnoid Haemorrhage and Intracranial Aneurysms : What. 2002;(August 2008):28–33

6. Continuum (minneap minn) 2018;24(6, neurocritical care): 1623–1657

7. Ross N, Hutchinson PJ, Seeley H, et al. Timing of surgery for supratentorial aneurysmal subarachnoid haemorrhage: Report of a prospective study. J Neurol Neurosurg Psychiatry. 2002;72(4):480–4

8. Kaufmann TJ, Iii JH, Mandrekar JN, et al. Complications of Diagnostic Cerebral Angiography : Evaluation Methods : Results : Conclusion : Neuroradiology. 2007;243(3):812–9

9. Willinsky RA , Steve M, Taylor SM, et al. Neurologic Complications of Cerebral Angiography: Prospective Analysis of 2,899 Procedures and Review of the Literature. Radiology. 2003;227(2):522–8

10. Macdonald RL, Schweizer TA. Spontaneous subarachnoid haemorrhage. Lancet [Internet]. 2017;389(10069):655–66. Available from: http://dx.doi.org/10.1016/S0140-6736(16) 30668-7

11. Westerlaan H.E., Dijk van J.M.C., Jansen-van der Weide M.C, et al. Intracranial Aneurysms in Patients with Subarachnoid Hemorrhage : CT Angiography as a Primary Examination Tool for Diagnosis-Systematic Review and Purpose : Methods : Results : Radiology. 2011;258(1):134–45

12. Charles G. Report of World Federation of Neurological Surgeons Committee on a Universal Subarachnoid Hemorrhage Grading Scale. J Neurosurg. 1988;68(6):985–6

13. Frontera JA, Claassen J, Schmidt JM, et al. Prediction of symptomatic vasospasm after subarachnoid hemorrhage: The modified fisher scale. Neurosurgery. 2006;59(1):21–6

14. Young N, Dorsch NWC, Kingston RJ, Markson G,et al. Intracranial aneurysms: Evaluation in 200 patients with spiral CT angiography. Eur Radiol. 2001;11(1):123–30

15. Villablanca JP, Martin N, Jahan R, et al. Volume-rendered helical computerized tomography angiography in the detection and characterization of intracranial aneurysms. J Neurosurg. 2000;93(2):254–64

16. Karamessini MT, Kagadis GC, Petsas T, et al. CT angiography with three-dimensional techniques for the early diagnosis of intracranial aneurysms. Comparison with intra-arterial DSA and the surgical findings. Eur J Radiol. 2004;49(3):212–23

17. Hurley TR, Balandrin J. Perimesencephalic nonaneurysmal subarachnoid hemorrhage: Review of the literature . Neurosurgery. 1997;40(4):885

18. Bakker NA, Groen RJM, Foumani M,et al. Repeat digital subtraction angiography after a negative baseline assessment in nonperimesencephalic subarachnoid hemorrhage: A pooled data meta-analysis. A systematic review. J Neurosurg. 2014;120(1):99–103

19. Flemming KD, Lanzino G. Management of Unruptured Intracranial Aneurysms and Cerebrovascular Malformations. 2017;181–210