ORIGINAL ARTICLE

CEREBRAL ANGIOGRAPHIC FINDINGS IN NON TRAUMATIC INTRACRANIAL BLEED: UNENHANCED COMPUTED TOMOGRAPHIC CORRELATION

Jospaul Lukas¹, Gomathy Subramaniam², Jineesh T³, Noufal P⁴, V. R. Rajendran⁵, Padma Menon⁶, Saanida M. P⁷, Junaina P⁸

HOW TO CITE THIS ARTICLE:

Jospaul Lukas, Gomathy Subramaniam, Jineesh T, Noufal P, V. R. Rajendran, Padma Menon, Saanida M. P, Junaina P. "Cerebral Angiographic Findings in Non-Traumatic Intracranial Bleed: Unenhanced Computed Tomographic Correlation". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 41, May 21; Page: 7144-7153, DOI: 10.14260/jemds/2015/1039

ABSTRACT: AIMS: The aim of this study is to correlate the angiographic findings in spontaneous intracerebral haemorrhage with the CT determined site of haemorrhage, age of the patients, and pre-existing hypertension. It includes 62 cases of non-traumatic intracranial haemorrhage detected by CT at Government Medical College, Kozhikode, who underwent four vessel angiography via the transfemoral route from December 2013 to Sept. 2014. An attempt was made to predict the site of ruptured aneurysm causative for subarachnoid haemorrhage from NECT, which was compared with four vessel cerebral angiography. Association between independent variables was tested using the χ^2 test, $p < 0.05$ being significant. Validity parameters were used to compare CT with DSA for localisation of ruptured aneurysm. **RESULTS:** Angiographically detectable cause for non-traumatic intracranial haemorrhage was obtained in 85.5% cases evaluated. The most common vascular abnormality identified in the study was aneurysm (77.4%), followed by arteriovenous malformation (8%). 14.5% cases were angiographically occult. Among aneurysms, maximum number of ACom aneurysms were detected (45.8%), followed by ACA and MCA (18.8% each), PCom (14.6%), and 2.1% by basilar top aneurysm. Distribution of subarachnoid blood in the first CT after aneurysm rupture can be used to predict site of aneurysm rupture in case of ACA/Acom aneurysm rupture with reasonable specificity and positive predictive value, but not so in the case of MCA or posterior circulation aneurysms. According to this study there is no significant association between age, sex or presence or absence of hypertension and occurrence of angiographically detectable cause of non-traumatic intracranial haemorrhage. **Conclusions:** Thus all cases of non-traumatic intracranial haemorrhage should be evaluated by cerebral angiography irrespective of age, and hypertensive status.

KEYWORDS: Cerebral angiography; non traumatic intracranial bleed; hemorrhage; CT.

MESHTERMS:

- Cerebral Hemorrhage.
- Intracranial Hemorrhage.
- Aneurysm, Ruptured/complications.
- Aneurysm, Ruptured/radiography*.
- Aneurysm, Ruptured/surgery.
- Angiography, Digital Subtraction*.
- Female.
- Humans.
- Intracranial Aneurysm/complications.
- Intracranial Aneurysm/radiography*.

ORIGINAL ARTICLE

- Intracranial Aneurysm/surgery.
- Male.
- Sensitivity and Specificity.
- Subarachnoid Hemorrhage/etiology*.
- Subarachnoid Hemorrhage/radiography*.
- Tomography, X-Ray Computed*.

INTRODUCTION: Spontaneous intracranial hemorrhage refers to those cases that occur in the absence of trauma. One of the major management tasks is to find out whether hemorrhage is secondary to underlying structural vascular abnormality, such as arteriovenous malformation (AVM) and aneurysm, prior to treatment to prevent rebleeding. Despite great advances in imaging technology, such as CTA, MRI, and MRA, conventional catheter angiography remains the gold standard for diagnosis of vascular abnormality. The intracranial hemorrhage demonstrated on early CT images (Obtained within the first 24 hours) is classified according to the location of the bleed into parenchymal, intraventricular and subarachnoid. In case of subarachnoid bleed, specific cisternal site of the bleed is also assessed. Further an attempt is made to predict the site of ruptured aneurysm based on the site of subarachnoid haemorrhage. It has been documented that the site of haemorrhage, the patient's age, and the presence of preexisting hypertension are important factors affecting the likelihood of finding a vascular abnormality by cerebral angiography in spontaneous intracranial haemorrhage.

AIMS AND OBJECTIVES: To correlate the angiographic findings in spontaneous intracerebral hemorrhage (ICH) with the CT determined site of haemorrhage, age of the patients, and preexisting hypertension.

METHODS:

Study Design	Cross Sectional
Study Setting	Government Medical College, Kozhikode; Patients with CT evidence of intracranial hemorrhage
Study Period	From December 2013 to Sept 2014
Inclusion Criteria	Presence of non-traumatic intracranial hemorrhage
Exclusion Criteria	Poor surgical risk Severe neurological disability Refusal of angiography; Severe coagulopathy that accounted for the hemorrhage Bleeding into tumor that was diagnosed by CT or MRI
Sample size	60-70 cases of non-traumatic intracranial haemorrhage who undergo DSA
Study Method	Four vessel catheter Angiography via the femoral approach under local anesthesia was performed. For internal carotid angiogram, 8-10 ml of non ionic contrast medium (Ultravist –Iopromide 370 mg I/ ml) was used. Vertebral artery injections were done with 6-8ml of contrast. Image acquisition was done as Digital Subtraction Angiography using Alpha Impulse Cathlab, manufactured

ORIGINAL ARTICLE

	and supplied by Philips electronics Ltd., capable of online DSA at 3.7, 7.5, 25 and 30 frames / sec. A positive angiography was defined by the identification of a vascular abnormality accounting for the hemorrhage.
Study Method	Subarachnoid hemorrhage on NECT seen in anterior interhemispheric fissure /septum pellucidum/ pericallosal sulci were assumed to be from rupture of Acom /ACA aneurysm Subarachnoid haemorrhage in sylvian fissure from rupture of MCA/ ICA aneurysm Subarachnoid haemorrhage in perimesencephalic cistern / Prepontine cistern from rupture of Posterior circulation aneurysm
	This is compared with DSA findings (Gold standard) and validity parameters are assessed.
Statistical analysis	SPSS software. Validity parameters -- quantitative data. χ^2 test -- association between two independent variables.

STATISTICS: The Null hypothesis (H_0) assumes that there is no association between the predictor and outcome variables in the study population. When we conclude that there is statistical significance, the P value tells us what the probability is that our conclusion is wrong when in fact H_0 is correct. The lower the P value, the less likely that our rejection of H_0 is erroneous. By convention, most analysts will not claim that they have found statistical significance if there is more than a 5% chance of being wrong ($P=0.05$).

RESULTS: 62 patients of non-traumatic intracranial haemorrhage proven by CT, who underwent DSA were included in the study.

Site of bleed on CT	Number	Percentage
Subarachnoid hemorrhage	50	80.6
Intraparenchymal hemorrhage	12	19.4
Total	62	100

Table 1. Site of bleed on CT in study population

Of the DSA positive cases aneurysms and arteriovenous malformations were the identified causes for intracranial hemorrhage, with aneurysms accounting for 77.4% (48 numbers) and AVM 8% (5 numbers).

ORIGINAL ARTICLE

ORIGINAL ARTICLE

More number of angiographically positive intracranial hemorrhage were found in females. However, χ^2 test to determine association between sex and positive DSA finding revealed p value of 0.089, (>0.05). So according to this study, the chance of finding a positive DSA finding was independent of the sex of the patient i.e., there was no significant association between sex of the patient and the probability of finding a positive DSA finding.

Distribution of aneurysms is seen evenly in normotensives and hypertensives. All cases of arteriovenous malformation detected were seen in normotensives. 6(9.6%) normotensives have no identifiable cause of intracranial hemorrhage. However, χ^2 test to determine association between presence of hypertension and positive DSA finding revealed p value of 0.572, (>0.05), which is not significant. According to this, the chance of finding a positive DSA finding was independent of the hypertensive status of the patient.

Anterior circulation aneurysm	DSA positive	DSA negative	Total
Positive CT	31	7	38
Negative CT	0	12	12
Total	31	19	50

Table 2: Comparison of CT Vs Dsa In The Diagnosis of ACA / Acom Aneurysm

Detection of aneurysms of ACA and ACom by early CT as compared to a gold standard (DSA) had a sensitivity of 100% (31/31) positive predictive value of 81.6% (31/38), specificity of 63 % (12/19) and negative predictive value of 100% (12/12).

Middle cerebral artery aneurysm	MCA aneurysm	Negative for MCA aneurysm	Total
Positive s	9	23	32
Negative CT	0	18	18
Total	9	41	50

Table 3: Comparison of ct vs dsa in the diagnosis of MCA/ ICA aneurysm

ORIGINAL ARTICLE

Detection of aneurysms of MCA by early CT as compared to a gold standard (DSA) had a sensitivity of 100% (9/9) positive predictive value of 28.1% (9/32), specificity of 43.9% (18/41) and negative predictive value of 100%. (18/18)

Posterior circulation aneurysm	DSA Positive	DSA Negative	Total
Positive CT	8	31	39
Negative CT	0	11	11
TOTAL	8	42	50

Table 4: Comparison of CT Vs DSA in the Diagnosis of Posterior Circulation Aneurysm

Detection of aneurysms of posterior circulation by early CT as compared to a gold standard (DSA) had a sensitivity of 100% (8/8); positive predictive value of 20.5% (8/39), specificity of 26.2 % (11/54) and negative predictive value of 100% (11/11).

DISCUSSION: 62 cases of non-traumatic intracranial hemorrhage proven by CT were evaluated by DSA. Angiographically detectable cause for non-traumatic intracranial hemorrhage was obtained in 85.5% cases evaluated. The most common vascular abnormality identified in the study was aneurysm (77.4%), followed by arteriovenous malformation. Among aneurysms, maximum number of ACom (35.5%) aneurysms were detected, followed by ACA and MCA (14.5% each), PCom (11.6%), and by basilar top aneurysm (1.6%). Arteriovenous malformations accounted for 8% cases. 14.5% cases were angiographically occult.

In studies by Kitkhuandee A (1) et al DSA findings are as described below.

	Kitkhuandee a et al ⁽¹⁾	Present study
Dsa positive	62.6%	85.5%
Aneurysm	57.6%	77.4%
Arteriovenous malformation	4.2%	8%
Other causes	Moyamoya disease – 0.8%	Nil
Angiographically occult	37.4%	14.5%

Table 5: Comparing distribution of DSA findings with previous studies

	Kitkhuandee a et al, ⁽¹⁾	Sinagawa t	Present study
Acom	35.5%	34.7%	35.5%
Anterior cerebral artery		8.2%	14.5%
Pcom	17.1%		11.3%
Middle cerebral artery	15.7%	25%	14.5%
Internal carotid artery	11.8%	24%	-
Basilar artery	2.6%		1.6%
Vertebrobasilar junction	1.3%		
Others	10.5%	10%	-

Table 6: Comparing distribution of aneurysms in various studies

ORIGINAL ARTICLE

Association of Intracranial Hemorrhage with Age, Sex and Hypertension: Considering any single decade, maximum number of cases of non-Traumatic intracranial hemorrhage were detected in the age group 50-59 years. Maximum angiographic yield was also observed in the 50-59 years age group.

Our study has found more number of angiographically occult lesions in males but this observation is not statistically significant (p value =0.089).

Similarly angiographically occult cases of intracranial hemorrhage were seen to be more frequently distributed in normotensives. However, this observation also has not reached statistical significance (p value=0.572)

Thus, according to our study there is no association between age, sex or hypertension and detection of positive angiographic finding.

This is in accordance with studies by McCormick et al,¹ who have found no positive association between hypertension and non-traumatic intracranial hemorrhage.

However studies by S F S Halpin,⁽²⁾ et al have found that positive angiographic findings are more common in younger individuals and normotensive patients in a study evaluating 102 cases of intracranial hemorrhage.

Mutlu et al,⁽³⁾ have also found a positive association between hypertension and non-traumatic intracranial hemorrhage.

X L Zhu,⁽⁴⁾ et al have also found that in patients with <45 years, and normotensives the detection of angiographically detectable abnormality is more.

CT to Predict Site or Ruptured Aneurysm: Considering distribution of subarachnoid hemorrhage in early CT taken within 24hours, based on previous studies, presence of subarachnoid hemorrhage in anterior interhemispheric fissure and / or septum pellucidum and / or pericallosal sulci is assumed to be due to Acom /ACA aneurysm rupture. Similarly presence of subarachnoid hemorrhage in sylvian fissure is equated to MCA/ ICA aneurysm. This is compared with DSA findings (gold standard) and validity parameters were assessed

Our study has found that detection of aneurysms of ACA and ACom by early CT as compared to a gold standard (DSA) had a sensitivity of 100% (31/31) positive predictive value of 79.5% (31/39), specificity of 74.2% (23/31) and negative predictive value of 100% (23/23). However the validity to detect MCA / ICA and posterior circulation aneurysms with CT is poor.

Positive predictive value for MCA / ICA aneurysms is only 28.1% and specificity is 56.6%.

In case of posterior circulation aneurysms positive predictive value is 20.5% and specificity is 42.6%.

This is very similar to results obtained by Karttunen et al,⁽¹⁾ and Vander Jagt M et al.⁽⁵⁾

REFERENCES:

1. Kitkhuandee A, Thammaroj J, Munkong W, Duangthongpon P, Thanapaisal C. Cerebral angiographic findings in patients with non-traumatic subarachnoid hemorrhage. J Med Assoc Thai. Thailand; 2012 Nov; 95 Suppl 1: S121-9.
2. Halpin SFS, Britton JA, Byrne J V, Clifton A, Hart G, Moore A. Prospective evaluation of cerebral angiography and computed tomography in cerebral haematoma. 1994; 1180-6.
3. MUTLU N, RG B, BJ A. Massive cerebral hemorrhage: Clinical and pathological correlations. Arch Neurol [Internet]. 1963 Jun 1; 8 (6): 644-61. Available from: <http://dx.doi.org/10.1001/archneur.1963.00460060074008>.

ORIGINAL ARTICLE

4. Zhu XL, Chan MS, Poon WS. Spontaneous intracranial hemorrhage: which patients need diagnostic cerebral angiography? A prospective study of 206 cases and review of the literature. *Stroke*. UNITED STATES; 1997 Jul; 28 (7): 1406–9.
5. Van der Jagt M, Hasan D, Bijvoet HW, Pieterman H, Dippel DW, Vermeij FH, et al. Validity of prediction of the site of ruptured intracranial aneurysms with CT. *Neurology*. UNITED STATES; 1999 Jan; 52 (1): 34–9.

Fig. 1

CASE 1: Unenhanced CT shows serpiginous hyperdensities with hyperdense blood density along the pericallosal region. DSA shows an arteriovenous malformation involving the corpus callosum with intranidal aneurysms and early drainage via deep veins.

Fig. 2

CASE 2: SAH in left ambient cistern, DSA showing Pcom aneurysm.

ORIGINAL ARTICLE

Fig. 3

CASE 3: Symmetric SAH seen in anterior interhemispheric fissure, suprasellar cistern, bilateral sylvian fissures. An anterior communicating artery aneurysm seen on DSA.

Fig. 4

CASE 4: CT showing massive SAH in basal cisterns, perimesencephalic cisterns, left sylvian fissure and in parietal cortical sulci. DSA revealed a left middle cerebral artery aneurysm.

ORIGINAL ARTICLE

AUTHORS:

1. Jospaul Lukas
2. Gomathy Subramaniam
3. Jineesh T.
4. Noufal P.
5. V. R. Rajendran.
6. Padma Menon
7. Saanida M. P.
8. Junaina P.

PARTICULARS OF CONTRIBUTORS:

1. Junior Resident, Department of Radiodiagnosis, Government Medical College, Kozhikode.
2. Additional Professor, Department of Radiodiagnosis, Government Medical College, Kozhikode.
3. Assistant Professor, Department of Radiodiagnosis, Government Medical College, Kozhikode.
4. Assistant Professor, Department of Radiodiagnosis, Government Medical College, Kozhikode.

FINANCIAL OR OTHER

COMPETING INTERESTS: None

5. Professor & HOD, Department of Radiodiagnosis, Government Medical College, Kozhikode.
6. Junior Resident, Department of Radiodiagnosis, Government Medical College, Kozhikode.
7. Assistant Professor, Department of Radiodiagnosis, Government Medical College, Kozhikode.
8. Assistant Professor, Department of Radiodiagnosis, Government Medical College, Kozhikode.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Jospaul Lukas,
Nakkuzhikatt, Nazareth Hill,
P. O. Kuravilangad,
Kottayam, Kerala, India.
E-mail: jpl5686@gmail.com

Date of Submission: 24/04/2015.
Date of Peer Review: 25/04/2015.
Date of Acceptance: 13/05/2015.
Date of Publishing: 19/05/2015.