To Compare Aneurysmal Findings of CTA with Surgical Findings in Patients of Aneurysmal Subarachnoid Haemorrhage

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ABSTRACT

Objective: *To compare aneurysmal findings of CTA with surgical findings in patients of aneurysmal subarachnoid haemorrhage.*

Materials and Methods: *This descriptive study was conducted in the department of Neurosurgery, Lahore General Hospital Lahore over a period of nine months from 10th November 2008 to 9th August 2009. Study comprised of thirty five patients after fulfilling the inclusion and exclusion criteria. All computed tomography angiography (CTA) findings about aneurysmal site, size, side, shaper, neck, direction of fundus, detection perforators and vasospasm were noted by the researcher and compared with surgical findings.*

Results: *On CTA finding of aneurysms, there were 14 (40%) patients of small size (< 7 mm), 12 (34.3%) of large size (7 – 20 mm) and 9 (25.7%) of giant size (> 20 mm). In surgical finding, there were 14 (40%) patients of small size, 11 (31.4%) of large size and 10 (28.6%) of giant size. On CTA finding, there were 31 (88.6%) patients of sacular shape, 2 (5.7%) patients of fusiform shape and 2 (5.7%) patients of bilobed shape. In surgical finding, there were 29 (82.9%) patients of sacular shape, 2 (5.7%) patients of fusiform shape and 4 (11.4%) patients of bilobed shape. On CTA finding, there were 21 (60%) patients of narrow neck (< 2 mm) and 14 (40%) patients of wide neck (> 2 mm). In surgical finding, there were 17 (48.6%) patients of narrow neck (< 2 mm) and 18 (51.4%) patients of wide neck (> 2 mm).*

Conclusion: *It is concluded from this study that there is only minor difference exist between the CTA finding and intraoperative findings of aneurysm. This difference was seen in neck of aneurysm and perforators. In surgical finding the surgeon must be prepared for any unseen event about aneurysm, vessels and surrounding tissue.*

Key words: *Aneurysm, Subarachnoid Haemorrhage, CT angiography, intraoperative findings.*

Abbreviations: *AVM: Arteriovenous Malformation. DSA: Digital Subtraction Angiography. CTA: Computed Tomographic Angiography.*

INTRODUCTION

Subarachnoid haemorrhage is defined as blood in subarachnoid space between arachnoid and piamatter.[1] The incident of subarachnoid haemorrhage is six cases per 100,000 population. 10-15% patients die before arriving in hospital and average survival rate is 50%.[2]

In 80% cases cause of spontaneous subarachnoid haemorrhage is aneurysmal rupture,[3] while in 4-5% of cases it is caused by arterio venous malformation (AVM). Other causes of spontaneous subarachnoid haemorrhage are anticoagulant therapy, blood dyscrasias etc.

Headache, vomiting, drowsiness, unconsciousness and fits are most common clinical symptoms.[4] Physical examination may reveal meningism, retinal haemorrhage, loss of consciousness and neurological deficits[3] (nerve palsy, hemiplagia, hemiparesis, aphasia and dysphasia). Main complications related to subarachnoid haemorrhage are rebleed, vasospasm, hydrocephalus and seizures.[5]

After confirmation of subrachnoid haemorrhage on CT scan, the definitive investigation to delineate aneurysm, size of aneurysm, shapes of aneurysm, type of aneurysm, perforators, vasospasm, direction of aneurysm fundus and para aneurysm major vessels is digital subtraction angiography (DSA).[6] Digital Subtraction Angiography fails to disclose aneurysm in 10 – 20% cases of subarachnoid haemorrhage because of vasospasm and thrombosis.[6]

Computed tomographic angiography (CTA) is non invasive, more sensitive and specific investigation for confirmation of aneurysmal site (anterior circulation and posterior circulation), size (small < 7 mm, large 7 – 20 mm and giant > 20 mm), side (right and left), shape (sacular, fusiform and bilobed), neck (narrow < 2 mm and wide > 2 mm), direction of fundus (superior, inferior, anterior and posterior), detection of perforators and vasospasm.[6]

In literature, CTA has proven sensitivity 98%, specificity 100% while its positive predictive value is 100%.[6] It is not invasive, cheaper, readily available and can be done at the time of doing CT scan if there is suspected aneurysmal bleed.[2,7]

Aneurysmal findings of Digital Subtraction Angiography and surgical findings of aneurysms revealed same result about aneurismal shape in 84% cases, size 88% cases, neck of aneurysm 88% cases, direction of fundus 96% cases, detection of perforators 76% cases and detection of vasospasm in 92% cases.[8]

In this study the percentage difference of aneurismal findings of computed tomographic angiography is compared with peroperative findings of aneurysms.

MATERIALS AND METHODS

This cross sectional study was carried out in the Department of Neurosurgery, Lahore General Hospital, Lahore over a period of nine months from 10th November 2008 to 9th August 2009. All adult patients aged 20 – 70 years of age and both sexes of subarachnoid haemorrhage who diagnosed as intracranial aneurysms on CTA and patients with subrachnoid haemorrhage grade I, II, III according to World Federation of Neurosurgeon were included. Patients medically unfit who could not undergone surgery using general anaesthesia, vegetative patients, WFNS grade IV and V and spontaneous subarachnoid haemorrhage due to other causes than aneurysm were excluded.

An informed consent was taken from the patient or the attendant of patient. All CT angiography findings about aneurismal site (anterior circulation and posterior circulation), size (small < 7 mm, large 7 – 20 mm and giant > 20 mm), side right and left), shape (sacular, fusiform and bilobed), neck (narrow < 2 mm and wide > 2 mm), direction of fundus (superior, inferior, anterior and posterior), detection of perforators (present, absent) and vasospasm (present, absent) were noted by the researcher and compared with surgical findings.

All the collected data was entered into SPSS version 11 and analyzed accordingly. The quantitative variable like age was presented by calculating mean and standard deviation. The qualitative variables like sex, finding of CTA and surgery about aneurysmal size (small < 7mm, large 7–20 mm and giant >20mm), shape (sacular, fusiform and bilobed), neck (narrow < 2 mm and wide > 2 mm), direction of fundus (superior inferior, anterior and posterior), perforators (present or absent and vasospasm (present or absent) were presented in the form of percentage and frequency.

RESULTS

The mean age of the patients was 47.4 ± 10.0 years. There were 2 (5.7%) patients in the age range of 20 – 30 years, 1 male and 1 female, 4 (11.4%) patients of age range of 31 – 40 years, 1 male and 3 females, 17 (48.6%) patients of age range of 41 – 50 years, 8 male and 9 females, 10 (28.6%) patients of age range of 51 – 60 years 5 male and 5 females, and 2 (5.7%) patients of age range of 61 – 70 years 1 male and 1 female (Table 1).

Table 1: *Distribution of patients by age and sex (n = 35).*

Age (Years)	Male	Female	Total
20 – 30	1	1	2
31 – 40	1	3	4
41 – 50	9	8	17
51 – 60	5	5	10
61 – 70	1	1	2

In the distribution of size of aneurysm, on CTA finding, there were 14 (40%) patients of small size (< 7 mm), 12 (34.3%) patients of large size (7 – 20 mm) and 9 (25.7%) patients of giant size (> 20 mm). In surgical finding, there were 14 (40%) patients of small size (< 7 mm), 11 (31.4%) patients of large

size (7 – 20 mm) and 10 (28.6%) patients of giant size (>20 mm).

Table 2: *Distribution of patients by findings of CTA and surgery (n = 35).*

Findings	CTA Findings	Surgery Findings
Size of Aneurysm		
Small (<7mm)	14 (40.0%)	14 (40.0%)
Large (7-20)	12 (34.3%)	11 (31.4%)
Giant (>20mm)	9 (25.7%)	10 (28.6%)
Shape of Aneurysm		
Sacular	31 (88.6%)	29 (82.9%)
Fusiform	2 (5.7%)	2 (5.7%)
Bilobed	2 (5.7%)	4 (11.4%)
Neck of Aneurysm		
Narrow (<2mm)	21 (60.0%)	17 (48.6%)
Wide (>2mm)	14 (40.0%)	18 (51.4%)
Direction of Fundus		
Superior	20 (57.1%)	18 (51.4%)
Inferior	1 (2.9%)	1 (2.9%)
Anterior	11 (31.4%)	13 (37.1%)
Posterior	3 (8.6%)	3 (8.6%)
Perforators		
Present	20 (57.1%)	31 (88.6%)
Absent	15 (42.9%)	4 (11.4%)
Vasospasm		
Present	30 (85.7%)	26 (74.3%)
Absent	5 (14.3%)	9 (25.7%)
Site of Aneurysm		
Anterior circulation	35 (100.0%)	35 (100.0%)
Posterior circulation	0	0
Side of Aneurysm		
Left	19 (54.3%)	19 (54.3%)
Right	16 (45.7%)	16 (45.7%)

In the distribution of shape of aneurysm, on CTA finding, there were 31 (88.6%) patients of sacular shape, 2 (5.7%) patients of fusiform shape and 2 (5.7%) patients of bilobed shape. In surgical finding, there were 29 (82.9%) patients of sacular shape, 2 (5.7%) patients of fusiform shape and 4 (11.4%) patients of bilobed shape.

In the distribution of neck of aneurysm, on CTA finding, there were 21 (60%) patients of narrow neck (< 2mm) and 14 (40%) patients of wide neck (> 2mm). In surgical finding, there were 17 (48.6%) patients of narrow neck (< 2mm) and 18 (51.4%) patients of wide neck (> 2mm).

In the distribution of direction of fundus, on CTA finding, there were 20 (57.1%) patients of superior, 1 (2.9%) patient of inferior, 11 (31.4%) patient of anterior and 3 (8.6%) patients of posterior. On surgical finding, there were 18 (51.4%) patients of superior, 1 (2.9%) patient of inferior, 13 (37.1%) patient of anterior and 3 (8.6%) patients of posterior.

Regarding perforators, on CTA finding, there were 20 (57.1%) patients of present perforator and 15 (42.9%) patients of absent perforators. In surgical finding, there were 31 (88.6%) patients of present perforator and 4 (11.4%) patients of absent perforators.

When vasospasm is studied, on CTA finding, there were 30 (85.7%) patients of present vasospasm and 5 (14.3%) patients of absent vasospasm. In surgical finding, there were 26 (74.3%) patients of present vasospasm and 9 (25.7%) patients of absent vasospasm.

In the distribution of site of aneurysm, there were 35 (100%) patients of site of anterior circulation on CTA finding and surgical findings. In the distribution of patients by side of aneurysm, there were 19 (54.3%) patients of left side and 16 (45.7%) patients of right side on CTA finding and surgical finding.

DISCUSSION

An aneurysm can be defined as an abnormal circumscribed dilatation of an artery.[9] Subarachnoid haemorrhage occurring secondary to a rupture of an aneurysm in the cerebral circulation is a relatively common problem, with an incidence of 8 per 100,000 population per year although regional variations exist.[10-13]

After confirmation of subrachnoid haemorrhage on CT scan, the definitive investigation to delineate aneurysm, size of aneurysm, lobes of aneurysm, type of aneurysm, perforators, vasospasm, direction of aneurysm and para aneurysm major vessels position is digital subtraction angiography (DSA).[6] Digital subtraction angiography fails to disclose aneurysm in

10 – 20% cases of subarachnoid haemorrhage because of vasospasm and thrombosis.[6]

CTA has become increasingly utilized for the evaluation of cerebrovascular disease particularly for intracranial aneurysm. CTA is relatively fast minimally invasive and requires less mobilization of resources compared with four vessels angiography. In literature CTA has proven sensitivity 98%, specificity 100%, while its positive predictive value is 100%.[6]

Aneurysmal findings of digital subtraction angiography and surgical findings of aneurysms revealed same result about aneurysmal shape in 84% cases, size 88% cases, neck of aneurysm 88% cases, direction of fundus 96% cases, detection of perforators 76% cases and detection of vasospasm in 92% cases.[8]

In our study the mean age of the patients was 47.4 ± 10 years. As compared with the study of Butt et al[8] the mean age of the patients was 45.84 years. In another study conducted by Khan et al[14] the mean age of the patients was 46.38 ± 10.59 years, which are comparable with our study.

In our study there were 48.6% male patients and 51.4% female patients. As compared with another study,[8] there were 48% male patients and 52% female patients, which is same and comparable with our study.

In our study on CTA finding, there were 40% patients of small size (< 7 mm), 34.3% patients of large size (7 – 20 mm) and 25.7% patients of giant size (> 20 mm). In surgical finding, there were 40% patients of small size (< 7 mm), 31.4% patients of large size (7 – 20 mm) and 28.6% patients of giant size (> 20 mm). As compared with the local study[8] on CTA finding, there were 36% patients of small size, 32% patients of large size and 32% patients of giant size. In surgical finding, 28% patient of small size, 28% patient of large size and 44% patients of giant size which is comparable with our study.

In our study on CTA finding, there were 88.6% patients of sacular shape, 5.7% patients of fusiform shape and bilobed shape. In surgical finding, there were 82.9% patients of sacular shape, 5.7% patients of fusiform shape and 11.4% patients of bilobed shape. As compared with the study of Butt et al[8] on CTA finding, 96% patients of sacular shape and 4% patients of fusiform shape. In surgical finding, there were 84% patients of sacular shape, 8% patients of fusiform shape and 4% patients of bilobed shape, which is comparable with our study.

In our study on CTA finding, there were 60% patients of narrow neck (< 2 mm) and 40% patients of wide neck (> 2 mm). On surgical finding, there were 48.6% patients of narrow neck (< 2 mm) and 51.4% patients of wide neck (> 2 mm). As compared with another study,[8] there were 56% patients of narrow neck and 44% patients of wide neck on CTA findings and surgical finding, which is comparable with our study.

In our study, on CTA finding, there were 57.1% patients of superior fundus direction, 2.9% patient of inferior, 31.4% patient of anterior and 8.6% patients of posterior. On surgical finding, there were 51.4% patients of superior, 2.9% patient of inferior, 37.1% patient of anterior and 8.6% patients of posterior. As compared with another study,[8] on CTA finding, 36% patients of superior, 4% patient of inferior, 8% patients of anterior and 4% patient of posterior. On surgical finding, 40% patients of superior, 4% patient of inferior, 8% patients of anterior and 4% patient of posterior, which is comparable with our study.

In our study, on CTA finding, 57.1% patients had present perforator and 42.9% patients had absent perforators. In surgical finding, 88.6% patients had present perforator and 11.4% patients had absent perforators. While compared with the study of Farsad et al[15] on CTA finding, 64% patients had present perforator and 36% patients had absent perforator, which is comparable with our study.

In our study on CTA finding, 85.7% patients had present vasospasm and 14.3% patients had absent vasospasm. On surgical finding, 74.3% patients of present vasospasm and 25.7% patients of absent vasospasm. As compared with the study of Butt et al,[8] on CTA finding, 76% patients had present vasospasm and 24% patients had absent vasospasm, on surgical finding, 68% patients of present vasospasm and 32% patients of absent vasospasm which is comparable with our study.

Our experience of this study, we can say that CTA provide useful information for pre-surgical planning of aneurysmal surgery.

CONCLUSION

It is concluded from this study that there is minor difference exist between the CTA findings and intra-operative findings. The only difference was seen in neck of aneurysm and perforators. In surgical finding the surgeon must be prepared for any unseen event about aneurysm, vessels and surrounding tissue.

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REFERENCES

1. Van GJ, Kerr RS, Rinkel GJ. Subarachnoid haemorrhage. Lancet. 2007; 369: 306-18.
2. Hoh BL, Cheung AC, Rabinov JD, Pryor JC, Carter BS, Ogilvy CS. Results of a prospective protocol of computed tomographic angiography in place of catheter angiography as the only diagnostic and pretreatment planning study for cerebral aneurysms by a combined neurovascular team. Neurosurgery, 2004; 54: 1329-40.
3. Liebenberg WA, Worth R, Firth GB, Olney J, Norris JS. Aneurysmal subarachnoid haemorrhage guidance n making the correct diagnosis. Postgrad Med J. 2005; 81: 470-3.
4. Mazhar S, Naqvi A, Rana A, Basharat RA. A study on the frequency of electrocardiographic changes in patients with subarachnoid hemorrhage below 40 years of age. Pak J Neurol Srug. 2005; 9: 37.
5. Suarez JI, Tarr RW, Selman WR. Aneurysmal subarachnoid haemorrhage. N Engl J Med. 2006; 354: 387-96.
6. Agid R, Lee S, Willinsky R, Farb R, terBrugge K. Acute subarachnoid hemorrhage: using 64 – slice multidetector CT angiography to "triage" patients treatment. Nueroradiology, 2006; 48: 787-94.
7. Pechlivanis I, Schmieder K, Scholr M, Konig M, Heuser L, Hjarders A. 3-Dimensional computed tomogramphic angiography for use of surgery planning in patients with intracranial aneurysms. Acta Neurochir (Wlen) 2005; 147: 1045-53.
8. Butt B, Anwar M, Ashraf N, Javed A. Percentage difference in angiographic findings vs. per-operative findings and their implication in surgical management of subarachnoid haemorrhage. Pak J Neurol Surg. 2004; 8: 70-6.
9. Soybel D, Surgery. IN: Theralar DE, Hope RA, Longmore JM. Oxford handbook of clinical medicine. New York: Oxford University Press, 1999: 80-167.
10. Longmore M, Wilkinson I, Torok E, editors. Oxford handbook of clinical medicine. New York: Oxford University Press, 2001: 318-95.
11. Nilson OG, Lindgren A, Stalk N. Incidence of intracerebral and subarachnoid hemorrhage in Southern Sweden. J Neurol Neurosurg Psychiatr. 2000; 69: 601-7.
12. Ohkuma H, Fugita S, Suzuki S. Incidence of aneurismal subarachnoid hemorrhage in Shimokita Japan, from 1989 to 1998. Stroke 2002; 33: 157-9.
13. Hamada J Moriko M, Yano S. Incidence and early prognosis of aneurismal subarachnoid hemorrhage in Kumamoto. Prefecture, Japan. Neurosurgery, 2004; 54: 31-7.
14. Khan N, Ashraf N, Hameed A, Muhammad A. Diagnostic accuracy of ct angiography and surgical outcome of cerebral aneurysms. Pak J Neurol Sci. 2009; 4: 8-11.
15. Farsad K, Mamourian AC, Eskey CJ, Friedman JA. Computed tomographic angiography as an adjunct to digital subtraction angiography fo rthe pre-operative assessment of cerebral aneurysms. Open Neurol J. 2009; 3: 1-7.

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