



OUTCOME OF DIAGNOSTIC CEREBRAL ANGIOGRAPHY (DSA) IN RURAL HOSPITAL OF WEST BENGAL

Hilal Ahmad Ganaie

DM Neurology, Fellow ship in stroke and Neurointervention, Formerly DMPDT, Department of Neurology Burdwan Medical College., Burdwan west Bengal

Durga Prasad Rai*

DM Cardiology , Former DM PDT, Department of cardiology, Burdwan Medical college *Corresponding Author

ABSTRACT

Digital Subtraction Angiography (DSA) is the gold standard test to find the vascular etiologies of brain. In a rural hospital with poor socioeconomic status of patients, a hospital based Cardiac Cath lab can be used for the evaluation and management selected group of neurological patient of possible vascular origin

KEYWORDS :

Introduction

Stroke is a major health problem in India¹. The average annual incidence rate of strokes in a recent study from Kolkata was 145 per 100,000 population which compares well with the developed countries.² Stroke burden has been rising in India as compared to the developed countries where it has reached plateau or decreased.³ Stroke appeared to be the most common neurologic admission in the hospital.⁴ It had been found that stroke admissions account for 0.9-4.5% in general hospital and 9-30% in neurological wards.⁵ For immediate diagnosis and management of stroke patients, clinical evaluation and imaging are required (CT/MRI). Evaluation for cause of stroke needs complete hematological, biochemical profile, carotid Doppler, ECG, ECHO, Holter, MRI, magnetic resonance angiography (MRA) and CT Angiography (CTA), magnetic resonance venography (MRV) and some times, cerebral digital subtraction angiography (DSA) are required depending type of stroke, age of patient, location of the insult in brain, and atypical clinical presentations. Recent advances in noninvasive neurovascular imaging techniques, including MRA and CTA have reduced the number of catheter-based cerebral angiograms performed for purely diagnostic reasons. Cerebral digital subtraction angiography (DSA) remains, however the gold standard to find vascular abnormalities of the brain, such as arterial stenosis, arteriovenous malformation (AVM) and brain aneurysm.^{6,7}

Cerebral Digital subtraction Angiography has emerged as important diagnostic and therapeutic armamentarium for vascular lesions in brain. In view of rising stroke in developing countries, use of this modality has become an important technique for management of patients. Percutaneous endovascular diagnosis and therapy have been used worldwide as well as in India for the diagnosis and management of various cerebrovascular disease. Abnormal digital subtraction angiography (DSA) results have been reported in 39.6-76% of young stroke patients.^{8,9} In a rural hospital with poor socioeconomic status of patients where high cost neuroimaging is not afforded by most patient families, a hospital based central cardiac Cath lab can be used for coronary and cerebral angiography for the evaluation and management selected group of neurological patient of possible vascular origin.

Objective: - To determine the outcome of the diagnostic DSA in selected cases of neurological disorders of presumed vascular etiology, and to plan the further management of patients undergoing Cerebral DSA.

Material and Methods:-

We have selected a total of 29 patients from Dec 2013 - August 2015 having indication for DSA. Out of 29 patients, 25 stroke (out of total 150 stroke patients admitted) and 4 non-stroke patients were taken for DSA. Patients were kept fasting for 4-6 hrs before the procedure. We performed DSA in the Cath Lab of Burdwan Medical College with help of the cardiologist, interested in Neurointervention, after taking written consent. The procedure was done under local anesthesia. The femoral artery puncture was done and 6F sheath was used for cannulation. Nonionic contrast

media Omnipaque were used. Selective Aortograms were carried out in difficult cases with Pig tail catheter with 20-30 ml dye by pressure injector in Left anterior oblique view. Carotid and vertebral catheterization was done by using vertebral Guide catheter and Simson's catheter. A total of 6-8 ml dye was injected by 10 ml syringe to take one arterial and venous view for 3-4 seconds. Four vessels Cerebral DSA was done by taking run in lateral and AP view. Intermittent flushing techniques were used to prevent clots from developing in the catheter.

Results:-

Out of total 29 patients taken for DSA, Carotids arteries of 2 patients could not be negotiated due to technical problems and procedure was stopped to avoid any likely complication. Both of these patients had unfolding of aorta and high aortic pressure and one of them had type 3 arch and in rest 27 patients diagnostic cerebral angiography was successfully done. The catheter used were vertebral guide in 10 patients, Picard 13, sim (type 1 and 2) in 3 patients and radial access in one patient. Preangiogram of 27 patients were, ischemic stroke in 13, SAH in 8 patients, suspected arteriovenous malformation (AVM) in 2, in 2 and idiopathic intracranial hypertension (IIH) in 2 with suspected cortical vein thrombosis (CVT) and suspected case of chronic meningitis with unilateral complete 3rd nerve palsy in 1 patient. The age range of the pt was 22-60 year with mean age of 40.70 and sex ratio male and female 14:13. The relation of gender and hypertension and different age groups with different pre-angio diagnosis is shown in table 1&2.

Table 1. Showing Relation of Sex and Hypertension with Pre-angio Diagnosis.

			Pre-Angio Diagnosis					Total
			Ischemic stroke	SAH	AVM	CVT	Others	
SEX	Male	n	9	1	2	1	1	14
		%	33.3	3.7	7.4	3.7	3.7	51.9
	Female	n	4	8	0	1	0	13
		%	14.8	29.6	0	3.7	0.0	48.1
Total	n	13	9	2	2	1	27	
	%	48.0	33.3	7.4	7.4	3.7	100.0	
HTN	Yes		8	3	0	0	0	11
	No		5	6	2	2	1	16
Total			13	9	2	2	1	27

Table 2 :- Showing relation of age groups and pre-angio diagnosis

Diagnosis	AGE Group				Total
	20-30	30-40	40-50	50-60	
Ischemic stroke	5	2	3	3	13
SAH	1	2	4	2	9
AVM	2	0	0	0	2
CVT	0	2	0	0	2

others	0	1	0	0	1
Total	8	7	7	5	27

Diagnostic cerebral DSA results are shown in figure 1 and table 3. Out of 27 DSA (44.40 %) were normal and 15 (55.6%) had different abnormalities. Out of the 13 ischemic stroke patients 5 had normal DSA, 4 patients had Takayasu arteritis (TA), One proved MCA occlusion, two were having vertebral arterial diseases and one patient was having Moyamoya diseases. Out of four Takayasu arteritis who presented with ischemic stroke, 3 were females and one was male. 3 in 4 of the TA presented in young age (20-40yrs). Two patients had type one Takayasu arteritis, one patient had type 3 type takayasu with complete cut off descending aorta and one had type 5 TA who presented with heart failure and ischemic stroke. All the patients of Takayasu arteritis were put on medical management with steroids, aspirin and mycophenolate mofetil. Three patients having ischemic stroke had isolated intracranial vessel diseases, one had Middle cerebral artery diseases with complete occlusion of proximal right MCA and two had vertebral artery diseases. One of the ischemic stroke patient was having atypical acute frontal lobe behavior dysfunction presentation and he proved to have Moyamoya diseases and in him anterior circulation vessels were narrowed bilaterally with dominant posterior circulation with multiple collateral formation. There were 3 normal anatomical variation with three patients had nondominant anterior cerebral artery and one having Left fetal posterior cerebral artery with dominant left posterior communicating artery.

Out of 9 SAH patients eight were females and one was male. DSA of 7 SAH were normal and did not have any aneurysm, bleed was perimesencephalic bleed and were discharged with good prognosis. Two SAH patients had aneurysm, one on basilar top and other in the M2 segment of right MCA. Both were referred to higher centre for management. One of the patient had complete 3rd nerve palsy with pupillary involvement along with 4th and trigeminal ophthalmic division and headache. He had a big Left Internal cerebral artery cavernous aneurysm. Out of two suspected AVM patients, DSA

Table 3:- Showing Relation of pre-angio diagnosis and DSA results

	Normal	AVM	Takayasu Arteritis	Vertebral Diseases	MCA Diseases	Moyamoya Diseases	Aneurysm	CVT	Total
Ischemic stroke	5	-	4	2	1	1	-	-	13
SAH	7	-	-	-	-	-	2	0	9
AVM	0	2					-	0	2
CVT							-	2	2
Aneurysm Non-SAH							1	0	1
Total	12	2	4	2	1	1	3	2	27

After analyzing and discussing the cerebral DSA of each patient, only 6 (22.5%) patients were referred to higher centre for therapeutic intervention and rest 22 (77.5 %) patients managed conservatively and are on regular follow up. Referred patients were 3 aneurysm cases, one AVM case and one Complete MCA Occlusion and one Takayasu arthritis with complete abdominal aorta cut off. The rest information about subgroups of various patients and final decision about management is described in tables 4 & 5.

Table 4:- Relation of Preangio-diagnosis patient and Management after Cerebral DSA

		Conservative Management	Referred to higher center	Total
Ischemic stroke	n	11	2	13
	%age	40.7%	7.4%	48.1%
Sub arachnoid Hemorrhage	n	7	2	9
	%age	25.9%	7.4%	33.3%
Arteriovenous malformation	n	1	1	2
	% age	3.7%	3.7%	7.4 %
Cortical venous Thrombosis	n	2	0	2
	% age	7.4%	0.0	7.4%
Others	n		1	1
	% age		3.7	3.7
Total	n	21	6	27
	% age	77.8%	22.2%	100.0

resulted were confirmatory. One AVM patient had a of parietal bleed and recurrent sensory seizure of right side of body and cerebral angiography showed large high flow AVM in left Middle Cerebral Artery and patient was operated. Another atypical AVM patient was having mild headache only, and angiography showed high flow deep AVM with feeders from both ACAs draining into basal veins giving a picture of python. Patient was managed conservatively in accordance with ARUBA trial. Two IHH patients were having stasis of dye in venous phase, one was having cortical venous thrombosis and another as deep cortical venous thrombosis. Cost of DSA were affordable to all patients and equal the noninvasive imaging modalities.

The patients who underwent procedure had only few complications one patient had mild hypersensitivity reaction. Total dye used during procedure a single DSA procedure ranged from 75-125 ml. One patient a case of recurrent ischemic stroke with resistant hypertension with renal artery stenosis developed pseudohematoma at the puncture site and was managed conservatively by prolonged pressures.

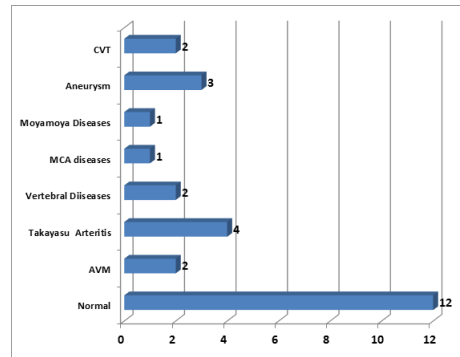


Figure 1:- Showing the result total 27 patients who underwent the cerebral DSA

Table 6:- Showing Management plan after cerebral DSA results

DSA Results	Conservative Management	Referred Higher centre	Total
Normal	12	0	12
AVM	1	1	2
Takayasu arteritis	3	1	4
Vertebral diseases	2	0	2
MCA Diseases	0	1	1
Moyamoya Diseases	1	0	1
Aneurysm	0	3	3
CVT	2	0	2
Total	21	6	27

Table 6:- Showing the results of various diagnostic studies

Diagnostic DSA Studies	Results Of Studies
Smoker et al ¹³ (1987)n= 93	Branch occlusions 25(27%), Normal 22(24%) Atherosclerotic cerebrovascular disease 16 (17%) Intraluminal clots 11 (12%), Vascular dissections 12 (13%) Moyamoya disease 5(5%) Cerebral aneurysms 4(4%) fibromuscular dysplasia 3(3%) Miscellaneous 2
Kimeli D e tal ¹⁵ (2006) n= 88	Normal (22.7%), Aneurysm (40.9%), Vascular stenosis/spasm (14.8%), AVM (8.0%)

Fritz SU et al ¹⁴ (2012) n= 200	Normal 37 (18.5 %) Intracranial AVMs 18 (9.0 %) Intracranial aneurysm 8 (4.0 %) Extracranial stenosis/occlusion 72 (36.0 %) Intracranial stenosis/occlusion 65 (32.5 %)
Our study (2013) n=27	Normal 12 (43.5%), Arteritis 5(18.%) , Non arteritis large vessel diseases3(11.3%) Aneurysm 3 (11.3 %)AVM 2 (7.6%) and CVT 2 (7.6%) ,

Discussion:

This study showed a group of 27 patients out of 150 who underwent DSA of brain and it showed positivity in 15 (57%) of cases. Among the cases, the outcomes were arteritis in 5 cases (Takayasu-4; Moya-moya-1), AVM in 2 cases, nonarteritic large vessel disease in 3, aneurysm in three, cerebral venous thrombosis in 2. As we have started the diagnostic DSA in a peripheral rural hospital selective patient selection, we followed strict indication to select our cases. Apart from clinical we got support from other noninvasive neuroimaging . We adopted procedure under local anesthesia similar to study by Robert A willinsky et al who performed majority of their indoor cases with local anesthesia. Only 27 of DSA within 7 months were performed in our hospital which is lower than another study by Miguel A. and et al who performed 115 DSA in first 6 months, and majority of the cases were 75.8 % were only diagnostic. DSA¹⁰. As we are in early phase of diagnostic DSA, we plan to perform therapeutic intervention after increasing our expertise and lack of affordability of affected subjects due to high cost of appliances. Smoker W R and et al in a series of 93 patients had 76% were having abnormalities¹³. Fritz S U, Shakir H and et al all only and 81.5 % had abnormalities¹⁴. Both had higher abnormalities than this present study. These variations could be due to patient selection bias , experience of interventionists, availability of non-invasive diagnostic facilities at the institution and type of patients admitted or referred and affordability of patients. Despite the increased use and availability of noninvasive brain vascular imaging, DSA continues to be used in a variety of indications and appears to yield additional meaningful information despite prior imaging. We did observe a higher percentage of new findings in diagnostic DSA. The combined transient and reversible neurologic complication rate of cerebral angiography has been reported to be as low as 0.4% and as high as 12.2%. The reported permanent neurologic complication rate varies from 0% to 5.4%¹¹. Willinsky R.A prospective studies of 1,000 or more procedures reveals a combined transient and reversible neurologic complication rate from 0.4 % to 2.3 % (mean, 1.3 %), a permanent neurologic complication rate from 0.1% to 0.5%. and a mean overall rate of 1.6%. Our series had two patients of hypersensitivity reaction and one pseudohematoma formation and no procedure related permanent neurological deficit After analyzing the DSA of each patient 21 (77.8 %) patients were managed in our hospital and are on regular follow up and only 6 (22%) patients were referred for the definitive neurointervention. Very few patients were referred to higher center thus avoiding the hassles as commonly experienced by rural people. The early angiography in selected patients is more likely to provide more diagnostic information, assists in planning future treatment plans, and provides valuable prognostic information. In a rural hospital where availability and quality of noninvasive diagnostic modalities for neurological patients of presumed vascular etiology is less available and with low socioeconomic status of patients diagnostic DSA is proving very helpful in complete diagnosis, prognosis and further management of patients with cost effectiveness. We plan to undertake therapeutic intervention in future

REFERENCES

- Poungavarin N. Strokes in developing countries. *Lancet* 1998;352:(S11)19-22.
- Das SK, Banerjee TK, Biswas A et al. A prospective community-based study of stroke in Kolkata, India. *Stroke* 2007;38:906-10.
- Garraway WM, Wishnant JP, Drury I. The continuing decline in the incidence of stroke. *Mayo Clin Proc* 1983;58:520-3.
- Owolabi LF, Shehu MY. Pattern of neurological admissions in the tropics *Ann Indian Acad Neurol*. 2010 Jul-Sep; 13(3): 167-170.
- Jain S, Maheshwari MC. Cerebrovascular diseases a review of Indian experience in last 35 yrs. *Neuroepidemiology* 1986;5:1-16
- Okahara M, Kiyosue H, Yamashita M, Nagatomi H, Hata H, Saginoya T, et al. Diagnostic

- accuracy of magnetic resonance angiography for cerebral aneurysms in correlation with 3D-digital subtraction angiographic images: a study of 133 aneurysms. *Stroke* 2002;33:1803-8
- Van Rooij WJ, Sprengers ME, de Gast AN. 3D rotational angiography: the new gold standard in the detection of additional intracranial aneurysms. *Am J Neuroradiol* 2008;29:976-9
- Adams HP Jr, Kappelle LJ, Biller J, et al. Ischemic stroke in young adults: experience in 329 patients enrolled in the Iowa Registry of stroke in young adults. *Arch Neurol* 1995;52:491-495.
- Chan MT, Nadareishvili ZG, Norris JW. Diagnostic strategies in young patients with ischemic stroke in Canada. *Can J Neurol Sci* 2000;27:120-124.
- Carolei A, Marini C, Ferranti E, Frontoni M, Prencipe M, Fieschi C. A prospective study of cerebral ischemia in the young: analysis of pathogenic determinants. *The National Research Council Study Group. Stroke* 1993;24:362-367.
- Willinsky R.A., Taylor S.M., Terbrugge K, et al: Neurologic complications of cerebral angiography: prospective analysis of 2,899 procedures and review of the literature. *Radiology* 2003;227(2):522-52.
- Miguel A Barboza, Alberto Maud et al: First year experience of the Neurointervention programme at Paul L. Foster School of medicine Texas technical university medical centre of El Paso. *EL Paso Physicians; volume 35: number 3-2012*
- Smoker W R, Biller J: Angiography of nonhemorrhagic cerebral infarction in young adults. *Stroke*. 1987;18:708-711.
- Fritz S U, Shakir H: Safety of cerebral digital subtraction angiography : complication rate analysis. *Universica Medicina*, 2012;3:127-33.
- Chepsiror, Kimeli David Dr. MBChB: The Pattern of Radiological Findings Seen in Four-Vessel Cerebral Angiography done at the KNH and Nairobi Hospital Digital Repository, 2012-11-13T12:42:30Z.