

One year review of cerebral angiography for intracranial hemorrhage

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Received, December 12, 2003

Accepted, December 29, 2003

Cerebral angiography is one of the commonly performed diagnostic and sometimes therapeutic procedures in neuroradiology. We carried out a retrospective review of cerebral angiograms performed at Radiology Department, Tribhuvan University Teaching Hospital for intracranial hemorrhage over a period of one year. The purpose of this article is to analyze the various demographic, radiological, and angiographic parameters of patients who underwent cerebral angiograms for intracranial hemorrhage for one year.

Thirty-eight patients with intracranial hemorrhage underwent cerebral angiography. Seventeen were male and 21 were female among 38 patients. Age ranged from 9-71 years (mean = 42.4 years). The commonest diseases encountered were, cerebral aneurysms, 26 (68.9%), arteriovenous malformations (AVMs), 2 (5.3%); and Moya Moya disease, 1 (2.6%). Nine patients (23.7%) had normal angiograms. Among patients with cerebral aneurysms, 24 had saccular (92.2%), and 2 (7.8%) had fusiform aneurysms. One patient (3.8%) had mycotic aneurysm. One patient (3.8%) had multiple aneurysms. Seven patients (15.5%) showed vasospasm in which 5 (11.1%) had mild and 2 (4.44%) had severe vasospasm.

Thirty-five patients (92.1%) had uneventful periprocedural period. Two patients (5.3%) had transient neurological deterioration immediately after the procedure, which improved in a week. One patient died.

Even with limited resources cerebral angiography can be safely performed in our institution and will continue to be an important modality in the years to come.

Key Words: aneurysm, angiography, subarachnoid hemorrhage, vasospasm.

Since the advent of cerebral angiogram by Dr. Egas Moniz in 1927, catheter cerebral angiography is considered to be the gold standard for the diagnosis of the vascular disease of the central nervous system.⁵ Though early on, this procedure had high morbidity and mortality, the contrast agents and technology related to the procedure have now been refined so much so that it can now be performed with acceptable morbidity and mortality. The generally agreed upon indications for cerebral angiography are-

spontaneous subarachnoid hemorrhage (SAH), lesions suspicious for aneurysms, AVMs and vascular tumors. The role of the angiography is to identify the cause of the bleed, to define the relationship of the cause to the parent vessel, to show collateral circulation, and to assess vasospasm.⁹ In addition, endovascular procedures for the obliteration of the aneurysm are commonly performed. In selected cases an embolization procedure can be performed using various agents to decrease the blood flow to the lesion. However, it

has been found that even with the improvement in catheters, guide wires, and contrast media, significant neurological complications can occur in upto 2% of patients.¹¹ Complications are directly related to the volume of the contrast agent used, serum creatinine level, number of catheters used, duration of the procedure, and the patient's age.⁵

The purpose of this article is to analyze the various demographic, radiological and angiographic parameters of patients with intracranial hemorrhage who underwent cerebral angiograms over a period of one year at Tribhuvan University Teaching Hospital.

Materials And Methods

Data of patients who underwent cerebral angiography at the Department of Radiology and Imaging at Tribhuvan University Teaching Hospital from January 2003 to December 2003 were retrospectively analyzed. Thirty-eight patients had evidence of intracranial hemorrhage on imaging studies and these patients constitute the basis of this study. We analyze these 38 patients in terms of demographic, and angiographic parameters.

Description of the procedure

All patients scheduled for cerebral angiography underwent routine coagulation screening, serum creatinine level estimation, and screening for Human Immunodeficiency (HIV) and hepatitis virus infections. Patients were routinely kept nil per orally for 6 hours prior to the procedure. An informed consent was obtained either from the patient or from the patient's next of kin. Light sedation if needed was given and vital signs were monitored throughout the procedure. The femoral puncture site was shaved, prepared with povidone iodine solution and draped. The area was infiltrated with local anesthetic solution (2% lidocaine). Femoral artery catheterization was performed using Seldinger's technique.¹² Conventional image intensifier was used for the imaging purpose. Standard vascular access device, catheter and guide wires were used. Sixty five percent Diatrizoate Meglumine (angiografin) was used as the contrast agent. A small amount of Heparinized solution (5000 units of Heparin in 540 cc of normal saline) was used periodically to flush the catheter. Multiple standard views were obtained to diagnose and delineate the lesion. Patients were observed in the hospital for a minimum of 6 hours after the procedure.

Results

Demographics

Thirty-eight patients underwent cerebral angiography from January 2003 to December 2003 for intracranial hemorrhage in our institution. Among them, 17 were male and 21 were female. The age range was between 9 to 71 years with the mean age of 42.4 years. As shown in the table

1 age group 51-60 had the highest number of angiograms done.

Age groups	No. of patients	Percentage
0-10	1	2.6
11-20	3	7.9
21-30	4	10.5
31-40	7	18.4
41-50	10	26.3
51-60	9	23.7
>60	4	10.5

Table 1. Distribution of patients based on age groups.

Etiology and Diagnosis

Table 2 summarizes the angiographic diagnosis in 38 patients with intracranial hemorrhage. Cerebral aneurysms were detected in 26 patients (68.9%), Arteriovenous malformations (AVMs) in 2 (5.3%), and Moya Moya disease in 1(2.6%) patient (s). In nine patients (23.7%) cerebral angiography was normal. All these patients subsequently underwent either repeat cerebral angiogram or CT angiogram, which were all normal.

Twenty-six patients had subarachnoid hemorrhage as a clinical diagnosis before the angiogram. In patients with SAH, the grading of the SAH was done using Fisher's grading scheme.¹ Accordingly 2 patients were in grade I, three in grade II, 13 in grade III and 8 were in grade IV.

Diagnosis	No. of patients	Percentage
Aneurysms	26	68.9
AVMs	2	5.3
Moya Moya disease	1	2.6
Normal angiograms	9	23.7

Table 2. Diagnosis based on cerebral angiography in the series of 28 patients.

Description of the aneurysms

Twenty -six patients had 28 aneurysms as one patient had multiple aneurysms (bilateral middle cerebral artery bifurcation and on the anterior communicating artery). As per the size of the aneurysm, in 21 patients (55.2%) the aneurysm was less than 1 centimeter in diameter, in 4 patients (10.5%) it was 1-2.5 centimeters and in 3 patients it was greater than 2.5 centimeters in size.

Twenty-eight aneurysms in 26 patients are depicted in Table 3. There were 8 (28.6%) anterior communicating artery, 4 (14.3%) posterior communicating artery (2 on each side), 8 (28.6%) middle cerebral artery (2 on the right side and 6 on the left), 4 (14.3%) internal carotid artery (all

Type of aneurysms	No. of patients	Percentage
A Com	8	28.6
MCA	8	28.6

ICA	4	14.3
P Com	4	14.3
ACA	2	7.1
Basilar tip	1	3.5
PCA	1	3.5

*A Com, anterior communicating artery; MCA, middle cerebral artery; ICA, internal carotid artery; P Com, posterior communicating artery; ACA, anterior cerebral artery; PCA, posterior cerebral artery

Table 3. Distribution of anatomical location of 28 aneurysms in 26 patients*

on the left side), 1 (3.5%) basilar tip, 1 (3.5%) right posterior cerebral artery, and 2 (7.1%) right distal anterior cerebral artery (A2) aneurysms. Twenty-four aneurysms (85.7%) were saccular whereas 2 (7.1%) were fusiform in nature. One patient had mycotic aneurysm.

Morbidity and Mortality

Two patients (5.3%) experienced transient neurological deterioration after the procedure. One patient (2.6%) died. This 40-year-old patient with Grade 3 SAH on the CT scan developed a seizure immediately after the procedure followed by unconsciousness. Despite vigorous treatment he did not improve and died the same day. His cerebral angiogram revealed an anterior communicating artery aneurysm.

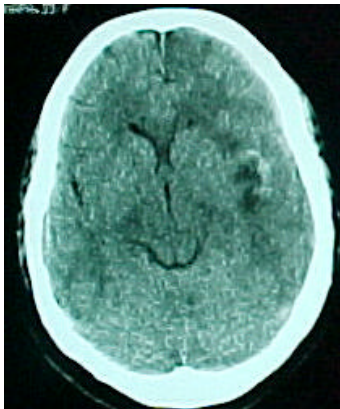


Figure 1. Noncontrast CT scan of head of a patient with sudden severe headache of 24 hours duration. Evidence of subarachnoid hemorrhage in the left sylvian fissure seen.

Discussion

Angiography was introduced into clinical practice during the 1920's,⁸ and rapidly diversified into a series of specialized modalities for studying different body regions. Since the discovery of cerebral angiography by Dr. Egas Moniz in 1927,⁸ for many years it remained the investigation of choice for a number of cerebrovascular

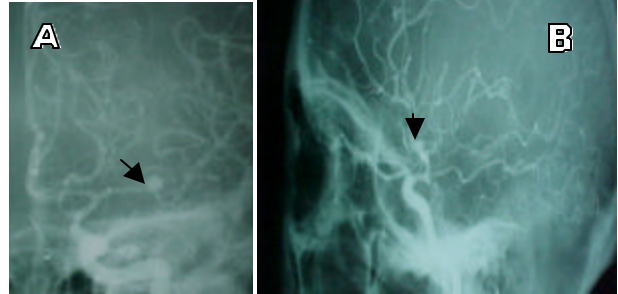


Figure 2. Cerebral angiogram, left internal carotid injection, anteroposterior (A) and lateral (B) view. A saccular aneurysm at the left middle cerebral bifurcation (arrows) is evident.

pathologies. With the introduction of new imaging modalities, such as CT and MRI, it was initially expected that angiography would be largely displaced. However, cerebral angiography continues to be a useful diagnostic and therapeutic tool. With the development of new contrast media, the improved catheterization techniques, and the progress in radiographic technique arising from the application of digital technology, the procedure can be done with a very low morbidity and mortality.⁸

Regarding the demographics, our patient population represented all age groups and there was no statistically significant sex predominance. As in other studies, aneurysms were the commonest intracranial pathology diagnosed by cerebral angiography in our series. Other diagnoses in order of frequency were, AVMs, and Moya Moya disease. Nine patients (23.7%) had normal angiography.

Aneurysms generally arise at the sites of arterial bifurcation.¹⁰ Hence the most frequent locations of aneurysms are at the anterior and posterior communicating arteries. Though different sources quote incidence differently, representative figures are as follows: anterior communicating artery 30-35%, internal carotid artery/posterior communicating artery 30-35%, middle cerebral artery bifurcation 20%, basilar artery 5%, and posterior fossa arteries distal to circle of Willis 1-3%.¹⁰

In our study, the commonest aneurysms were on the anterior communicating and middle cerebral arteries. In contrast to previously published reports, we had only 4 cases of posterior communicating artery aneurysms. This low number could either represent real low incidence in our population or could be due to introduction of bias associated with the small sample size.

In our study, only one patient had multiple aneurysms. Vajda found multiple intracranial aneurysm in 15% to 20% of cases.¹⁷ Stone et al. found that in a series of patients with multiple aneurysms, 75% of patients had two aneurysms, 15% had three, and 10% had more than three aneurysms.¹⁶

With the advent of early diagnosis of infections in the heart and development of good antibiotics, the incidence of mycotic aneurysm had significantly decreased over recent years. In our series only one patient was found to have a mycotic aneurysm. This 16-year-old girl with infective endocarditis presented with intracerebral hemorrhage. Cerebral angiography revealed an aneurysm on the cortical branch of the distal anterior cerebral artery, which disappeared in 3 months in repeat angiography. She was treated with antibiotics in the interval. Kaufman and colleagues found mycotic aneurysm in 2% to 3% of patients with intracranial aneurysms.⁴

In our series, 9 patients (23.7%) had no pathology detected on cerebral angiography. Subsequent conventional or CT angiograms were also normal in all patients. All patients had subarachnoid hemorrhage on CT scan of the head at presentation. This figure is slightly higher than previously published reports.^{14,15} The yield of cause in the subsequent angiography is low.^{2,14} Inamasu et al. retrospectively reviewed data of 316 patients with occult ruptured cerebral aneurysms by repeat angiography. 6% of patients with spontaneous SAH had initial negative angiograms. 36% of patients who had a negative initial angiogram had occult aneurysms in the subsequent angiograms.²

As noted in the previous studies and as found in our series also, cerebral angiography is not without risks.¹¹ Two patients in our series had transient neurological deterioration following the procedure. One patient died. Though the reason for death is presumptive in the absence of autopsy study, this most likely was due to re-rupture of the aneurysm either during or right after the procedure.

Johnston et al. in a study of 569 patients undergoing cerebral angiography analyzed the complications.³ The overall complication rate was 0.57% for stroke and 0.4% for TIA.³ Willinsky et al.¹⁸ in the analysis of 2,899 cerebral angiography, found neurologic complications in 1.3% of patients, of which 0.7% were transient, 0.2% were reversible and 0.5% were permanent.

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