Original Research Paper

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Radiology

DSA OF THE INTRACRANIAL VASCULAR SYSTEM IN INTRACRANIAL ABNORMALITIES

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ABSTRACT DSA (DSA) is a technique for demonstrating vascular anatomy by injecting iodinated contrast media directly into the arteries. DSA can detect various pathologies involving the cerebral vessels. In our hospital, many patients present with non-traumatic SAH and ICH. These can lead to neurological deficit, decreased or loss of consciousness or even can lead to death of the patients. But many a times the cause of these hemorrhage are often un-diagnosed. With the help of DSA, we can evaluate the cause of such hemorrhage, can plan for endovascular interventional procedures and can guide the clinician for treatment of these patients. **Objectives:** To study the common intracranial vascular abnormalities, to classify them according to their etiology and to emphasize the importance of precise diagnosis and its clinical implications. **Materials And Methods:** The study is conducted in the Department of Radiodiagnosis, GAUHATI MEDICAL COLLEGE AND HOSPITAL, GUWAHATI, during the period from August, 2020 to July, 2021. A sample of 46 patients was evaluated. DSA was carried out using the Siemens Artis Zee Biplane DSA machine in the Dept. of Radiology, GMCH. Following DSA, the findings are recorded in a structured format. Data collection, statistical analysis was performed using Microsoft Excel and was computed. **Results And Discussions:** The commonest pathological finding in our study was intracranial aneurysms, followed by arteriovenous malformations. The findings we obtained in our study were compared with the results of previous research works. **Conclusion:** With the help of DSA, we can diagnose aneurysms, AVMs and other pathologies involving intracranial vasculature. We can detect the accurate location, size and type of aneurysms, which can guide the further treatment plan of the patient.

KEYWORDS : DSA, Intracranial Vascular Abnormalities, Aneurysms, Arteriovenous Malformations, Endovascular Interventional Procedures, Diagnosis

INTRODUCTION:

Digital Subtraction Angiography (DSA) is a medical technique used to visualize the vascular anatomy by injecting iodinated contrast media directly into arteries. It was introduced by Moniz in 1927. DSA provides valuable information about flow dynamics and vascular anatomy, making it an essential tool in diagnosing various conditions.

DSA is particularly effective in detecting and locating intracranial aneurysms, which are focal dilations of blood vessels with different shapes and types. Ruptured cerebral aneurysms are a common cause of non-traumatic subarachnoid haemorrhages. For aneurysm detection, DSA is considered the gold standard. Additionally, DSA is essential for evaluating arteriovenous malformations (AVMs), anomalies that connect arterial and venous systems without capillaries. AVMs can cause future haemorrhages and are diagnosed using DSA. While DSA is a valuable diagnostic tool, it does have potential complications, including neurological issues such as stroke and non-neurological problems like arterial blockages, hematomas, and renal failure.

There are no absolute contraindications for cerebral angiography, but some relative contraindications include bleeding disorders, thrombogenic illnesses, skin infections, impaired renal function, cardiac problems, iodinated contrast allergies, pregnancy, and non-palpable pulse. In a hospital setting, DSA is crucial for diagnosing the cause of non-traumatic subarachnoid haemorrhages and intracerebral haemorrhages, enabling proper treatment and improving patient outcomes. By providing detailed images of vascular abnormalities, DSA plays a vital role in neurovascular assessments and guiding appropriate medical interventions.

AIMS AND OBJECTIVES:

1. To study normal intracranial vascular anatomy and its variants.
2. To study the common intracranial vascular abnormalities and to classify them according to their etiology.
3. To emphasize the importance of precise diagnosis and its clinical implications.

Methodology:

A sample of 46 patients with clinical suspicion of having any intracranial vascular abnormality were evaluated during the course of study. No selection bias was exercised in terms of patients' age, sex and pathology. A careful history was taken of all the patients. Any previous radiological investigation like CT brain, CT angiography brain, MRI brain, if done was carefully looked before diagnostic DSA was done.

Inclusion Criteria:

1. Patients suspected to have intracranial vascular abnormality on history and clinical examination and referred to the Department of Radiology.

Exclusion Criteria:

1. Patients with history of allergy to iodinated contrast agents.
2. Patients with abnormal renal function.
3. Patients with any coagulopathy.
4. Patients having local site infection.
5. Pregnant lady.

Patient preparation for diagnostic DSA:

All the patients were advised recent RFT, PT INR, BT and CT, viral markers including HbSAg, IgM antibody for HCV, HIV I and II were done. All the patients were also advised R/E blood, RBS before undergoing DSA. Patients with all the investigations within normal limits were advised to remain nil orally for 6 hours before DSA. Groin shaving of all the patients were done on the previous night or in the early morning in the day of DSA. The patients and the guardians were explained about the procedure and the possible adverse reactions of the procedure. A written informed consent was taken from the guardians of all the patients before DSA and the case was enrolled in the study.

Procedure

DSA machine which we used was a Siemens Artis Zee Biplane DSA machine. Equipments used were Puncture needle (18 G), arterial sheath (6F) with mini guide-wire, Head Hunter catheter (5F) and Terumo guide-wire (0.035" angled). Contrast used was Iohexol 350 mg/ml. Seldinger method was used to puncture the femoral artery. The double wall puncture technique was used in the majority of the cases. After the procedure, homeostasis was achieved by manual compression over the puncture site. Then a pressure bandage was applied for 8 to 12 hours. The patients were shifted to the respective wards and were advised immobilization for 6 to 8 hours. Following DSA, the findings are recorded in a structured format. Data collection, statistical analysis was performed using Microsoft Excel and was computed.

RESULTS AND OBSERVATIONS:

In our study, among the 46 patients, most of the patients were in the age group of 40-50 years followed by the age group of 60-70 years. The mean age of all the patients were 47.13 years. Among the 46 patients in our study, 23 were male and 23 were female. 26 patients had intracranial aneurysms, 5 had AVMs and 2 had Moyamoya disease. 23 patients had various anatomical variants with the commonest being absent or hypoplastic PCoA. The mean age was 50.19 years. Patients with aneurysm were slightly older than those with no aneurysm. According to age groups, maximum patients with aneurysms are in the age group of 50 – 60 years. The sex ratio in our study for aneurysms was found to be 1:1.6. In our study, most common location of aneurysm was ACA-ACom junction, followed by ICA.

Chart 1:Location of aneurysm

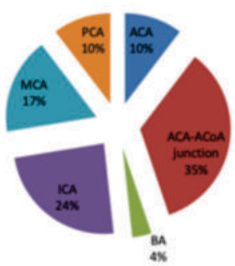
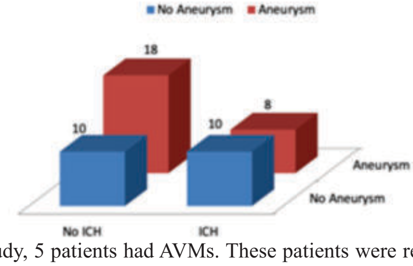
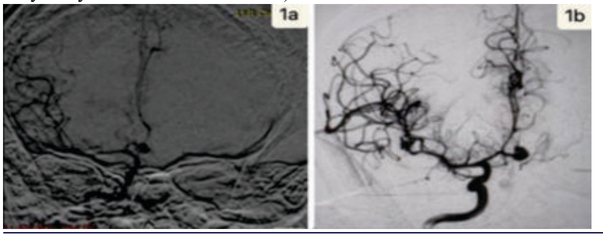


Chart 2: Distribution of aneurysms in patients with and without ICH



In our study, 5 patients had AVMs. These patients were relatively of younger age group with a mean age of 23.8 years. Four of the patients had superficial draining veins and only one patient had a deep draining vein. Applying Spetzler Martin grading, 3 patient had grade 2 lesion and 2 patients had grade 1 lesions.

Among the two patients with moyamoya disease, both were males. On angiography, one patient had unilateral and the other patient had bilateral involvement. On applying Suzuki grading system, one patient had grade IV (Development of ECA collaterals) disease and the other had grade III (Progressive ICA stenosis with intensification of moyamoya-associated collaterals) disease.



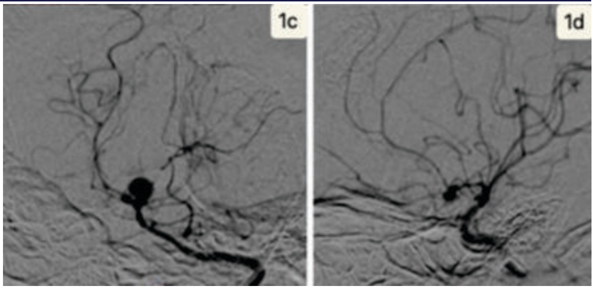


Image 1a shows right ICA DSA image showing saccular aneurysms in ACA-ACoA junction. Figure 1b Right ICA DSA showing a bilobed saccular aneurysm in the left ACA-ACo junction. The Al segment of the left ACA is absent / hypoplastic. Figure 1c, 1d shows multiple aneurysms involving bilateral PCAs and ACA-ACoA junction in a known case of SLE with vasculitis.

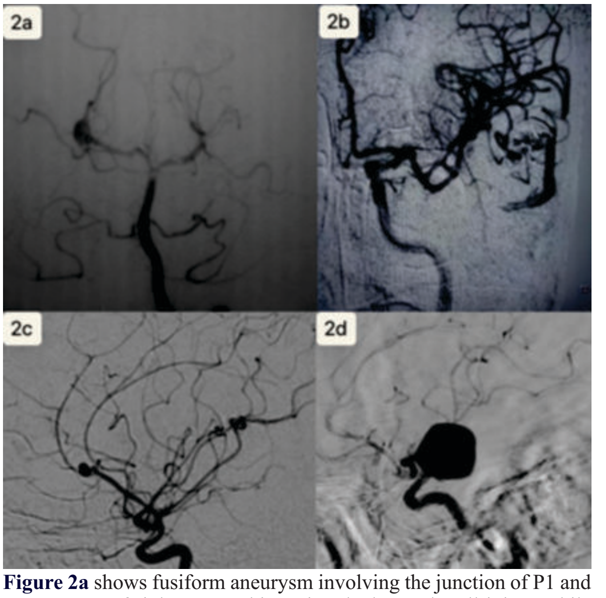


Figure 2a shows fusiform aneurysm involving the junction of P1 and P2 segment of right PCA. This patient had vessel wall injury while doing the right vertebral artery DSA. Figure 2b shows post embolization follow up DSA of another patient shows residual / recurrent lesion supplied by cortical branches of MCA and drained by vein of Labbe to transverse sinus. Right ICA DSA showing large fusiform aneurysm in supraclinoid ICA. Figure 2c shows right ICA DSA showing a saccular aneurysm in DACA. Figure 2d shows right ICA DSA showing large fusiform aneurysm in supraclinoid ICA.

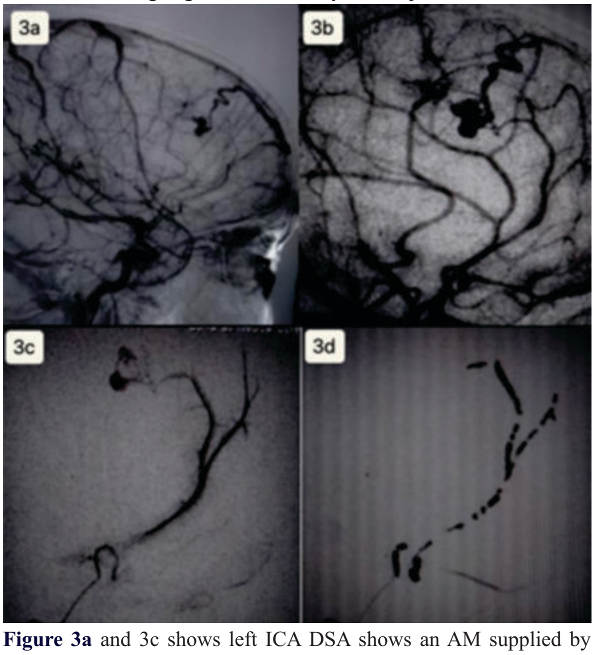


Figure 3a and 3c shows left ICA DSA shows an AM supplied by

cortical branches of MCA and drained by superficial vein to superior sagittal sinus. Embolization of this patient was done in our hospital. Figure 3c and 3d shows AVM and the arterial feeder during and immediately after embolization.

DISCUSSION:

In this study, we utilized DSA to investigate the intracranial vascular system and compared our findings with previous research. We found that intracranial aneurysms could occur across all age groups, with the highest incidence observed in individuals aged 50-60 years. Our results align with Amnat Kitkhuandee et al. and Jian-Ping Song et al., who reported similar mean ages of aneurysm presentation.

Regarding gender distribution, our study revealed a slight female predominance, which corroborated with Ali J. Ghods et al. but differed from Hasan, M. N et al. who reported a higher female-to-male ratio. The most common location of aneurysms in our study was at the ACA-ACoA junction, consistent with Amnat Kitkhuandee et al. and Hasan, M. N et al.

Saccular aneurysms, particularly those with narrow necks, were predominant in our study, a finding consistent with Hasan, M. N et al. However, the prevalence of aneurysms among smokers in our study differed from Amnat Kitkhuandee et al. and Jian-Ping Song et al., suggesting the need for further investigation.

DSA successfully detected vascular lesions in our study, with aneurysms being the most common, followed by AVMs and moyamoya disease. The rate of vascular lesion detection in our study was similar to that of Amnat Kitkhuandee et al. We also identified cases of anatomical variants involving the intracranial vascular system, similar to previous studies.

In conclusion, DSA proved to be a valuable tool for studying intracranial vascular anatomy and identifying pathological conditions. Our findings were generally consistent with previous research, but some variations emphasize the complexity of these vascular anomalies and the importance of individualized assessment and management. Continued research with larger cohorts may further enhance our understanding of these intracranial vascular conditions.

SUMMARY AND CONCLUSION:

In this dissertation, we conducted a study to examine the anatomy of the intracranial vascular system using DSA, as well as various anatomical variants associated with it. Among the anatomical variants, the most common were the absence or hypoplasia of the posterior communicating artery, followed by the absence of the A1 segment of the anterior cerebral artery (ACA). Our research revealed that the primary pathological findings were intracranial aneurysms, followed by arteriovenous malformations (AVMs), with a couple of cases of moyamoya disease.

The majority of aneurysms were located at the ACA-ACoA junction, internal carotid artery (ICA), and middle cerebral artery (MCA). Saccular aneurysms were the most frequent, with narrow-necked saccular aneurysms being the most common subtype. Our study indicated a correlation between age and aneurysm detection, with an increasing number of aneurysms detected with age up to the sixth decade, followed by a decrease thereafter. Additionally, we found a higher prevalence of aneurysms in females compared to males.

In terms of AVMs, five cases were identified, mostly presenting with intracranial hemorrhage (ICH). Patients with AVMs were generally younger, with three cases below 20 years of age. Two cases of moyamoya disease were also observed.

Despite its advantages, DSA has limitations, including a small sample size, time-consuming nature, and potential severe complications. Furthermore, DSA requires specific pre-procedure preparations and is more expensive compared to CT and MR angiography. Nevertheless, DSA remains the gold standard for diagnosing intracranial vascular pathologies.

The study emphasized the importance of DSA in detecting and accurately characterizing aneurysms and AVMs, providing crucial information for effective treatment planning. Such vascular anomalies can lead to serious consequences, including hemorrhage and neurological deficits, making early diagnosis and intervention essential for improving patient outcomes.

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