# Endovascular Embolization in a Rare Case of Left Basal Ganglia Large Arteriovenous Malformation with Hydrocephalus: A Case Report

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## Abstract

Brain arteriovenous malformation (AVM) is a rare congenital disorder affecting young adults with an incidence of 0.94 per 100,000 population. Intracranial digital subtraction angiography has to be done in all patients and grading of AVM is done as per Spetzler-Martin grading. We report a rare case of left basal ganglia large AVM treated by endovascular embolization. Our experience with endovascular embolization using Onyx is successful in the treatment of large brain AVM. Endovascular embolization with Onyx is safe and feasible in deeply located large AVMs of the brain. Our patient has postoperatively recovered completely without any neurological deficit.

**Keywords**
- brain AVM
- endovascular embolization
- hydrocephalus
- Onyx

## Introduction

Brain arteriovenous malformation (AVM) is a rare congenital disorder of intracranial vasculature supplying the brain parenchyma. Its incidence is 0.94 per 100,000 population. They are the potential source of intracranial hemorrhage especially in young adult. So, their site and size should be identified and treated on an early basis because they can get ruptured at any time and cause bleeding. Preoperatively, AVM size is estimated with magnetic resonance imaging (MRI) brain angiography, and all AVMs are classified according to the Spetzler-Martin scale. Brain AVM can be treated by many modalities such as open surgery, endovascular embolization, and stereotactic radiosurgery.

In general, AVMs of size larger than 3 cm are embolized to reduce size, to enhance the safety of surgery, and to make them amenable to radiosurgery. Nowadays, the endovascular approach to brain AVMs using different embolizing agents is a well-established treatment option. The procedure allows complete obliteration of the AVM in most of cases reported in different literature series. The incidence of major complications also varies widely, probably because successful treatment is highly operator-dependent. Nowadays, a new embolizing agent, Onyx has been marketed and is a preferred treatment of choice for endovascular embolization by most of the endovascular neurosurgeons in a case of deeply located large high flow AVM.

We report a case of left-side basal ganglia, moderate-size high-flow AVM treated by endovascular embolization using Onyx.

## Case Report

We report a case of 40-year-old male who came to us with complaints of headache on and off and diminution of vision in his right eye for the last 4 months. The symptoms of diminution of vision had increased for the last 1 month.

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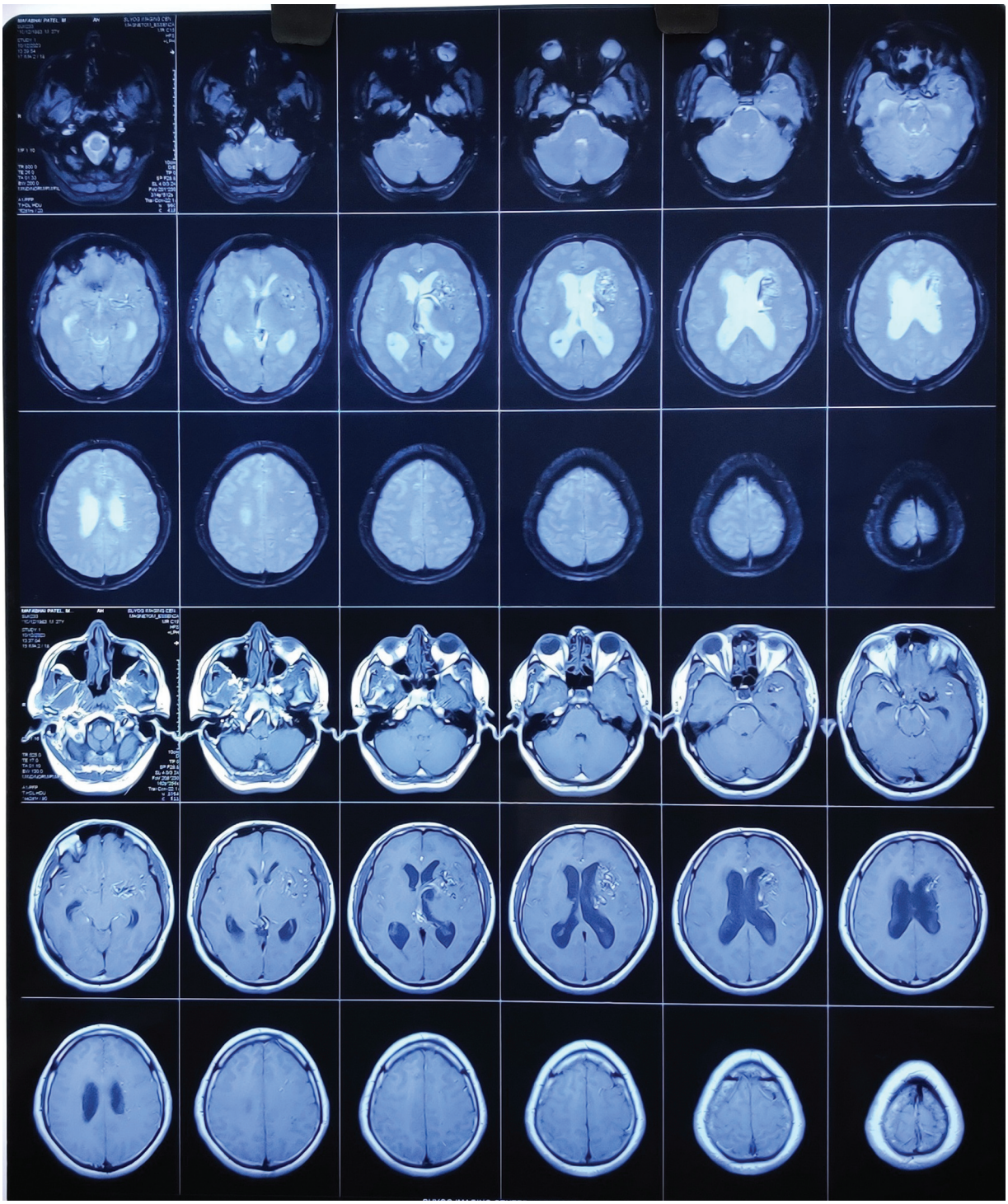

**Fig. 1** Preoperative axial T1-weighted magnetic resonance imaging showing altered isointense signal intensity lesion with multiple hypointense areas within it suggestive of left basal ganglia arteriovenous malformation.

On examination, he was fully conscious, oriented to time place and person and obeying verbal commands.

Vision examination was as follows: left eye—vision 6/6, right eye—only perception of light present. Bilateral pupil was normal size and equally reacting to light. Bilateral extraocular movement was normal and there were clinical findings of raised intracranial pressure in the form of headache and blurring of vision.

Fundoscopy examination showed bilateral optic disc edema, which was suggestive of papilledema.

We proceeded to do MRI of brain with intracranial angiography (►**Figs. 1** and **2**) which showed the large AVM involving the left basal ganglia measuring approximately $31 \times 21 \times 27$ mm (AP × TR × CC) (anterior-posterior x transverse x craniocaudal) with feeder from perforators of left middle cerebral artery and drainage into straight sinus via

 

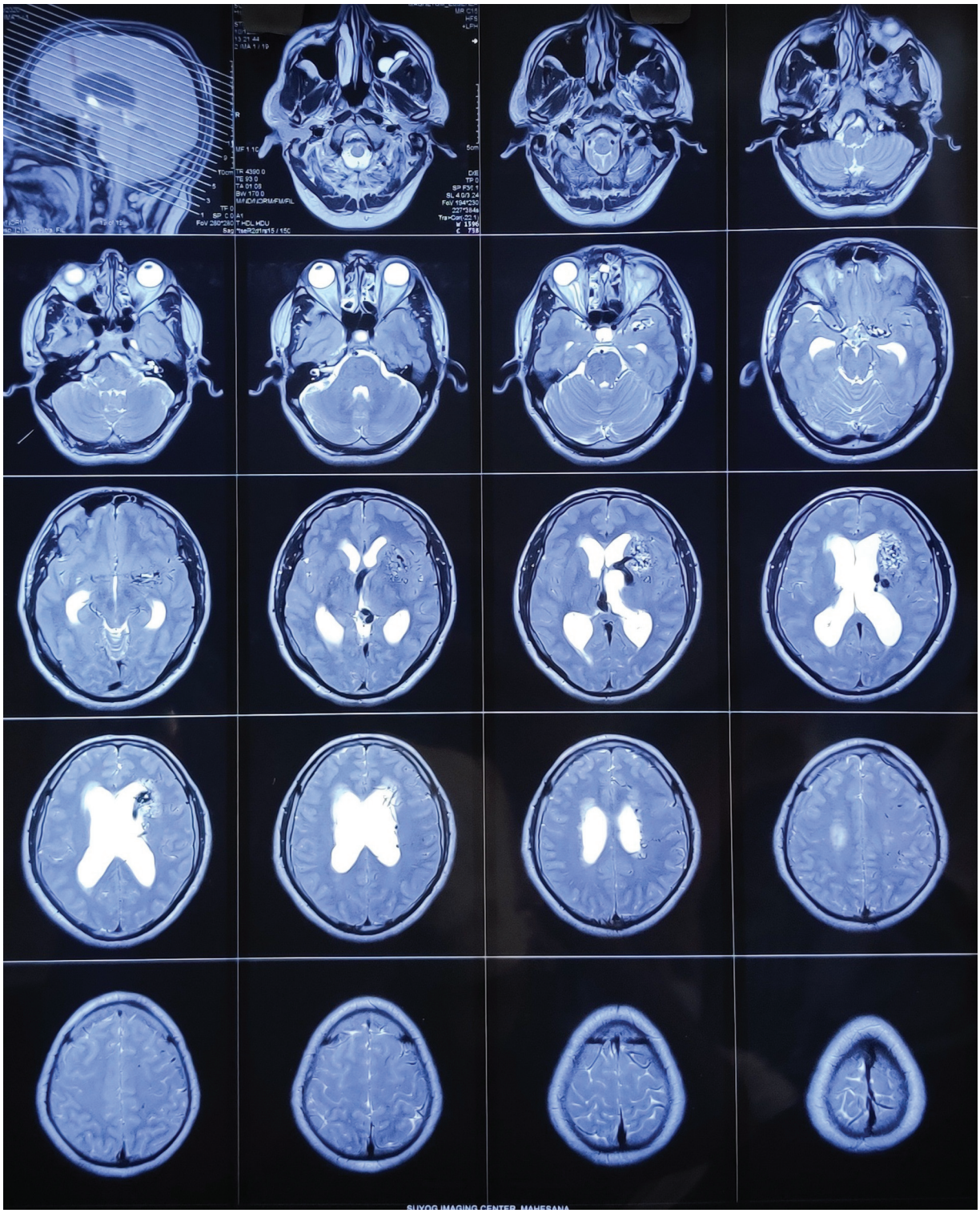

**Fig. 2** Preoperative axial T2-weighted magnetic resonance imaging showing multiple hyperintense signals in left basal ganglia region with hydrocephalus.

left thalamostriate vein (►**Fig. 3**). The ventricles were also dilated on MRI suggestive of hydrocephalus. So, the diagnosis was made for AVM of left basal ganglia with hydrocephalus.

We planned further to proceed with digital subtraction cerebral angiography of the brain which (►**Fig. 4**) showed that there was moderate-size flow AVM involving left basal ganglia that is supplied by perforators from left middle cerebral artery. It was draining into left caudate vein → left thalamostriate vein → left internal cerebral vein to the vein of Galen. So, the final diagnosis was made to be moderate-size high flow AVM (Spetzler-Martin scale grade 3) involving left basal ganglia with hydrocephalus.

After necessary preoperative workup, we planned to do endovascular embolization of AVM as early as possible

 

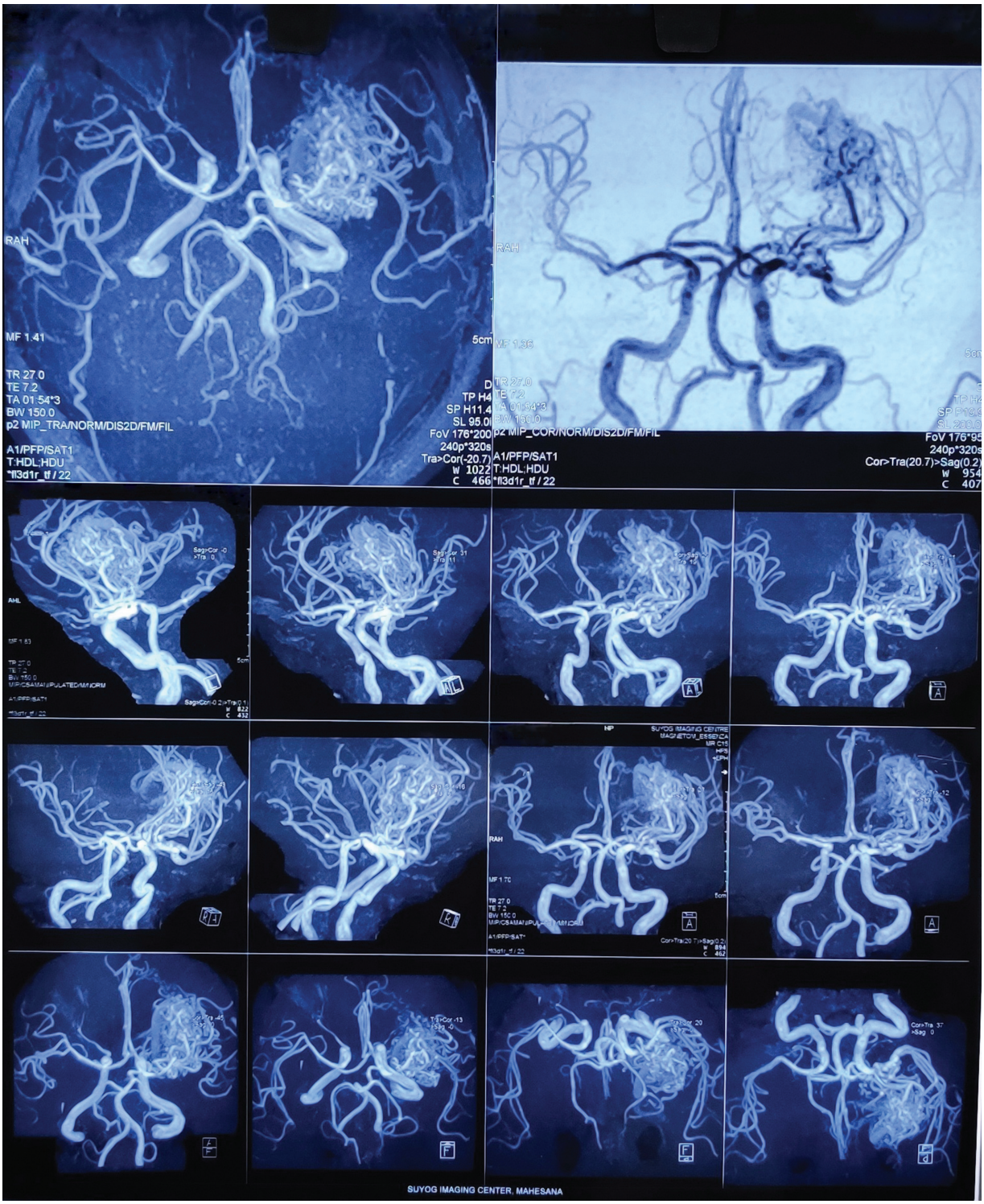


**Fig. 3** Preoperative magnetic brain resonance brain angiography showing serpiginous appearance with main arterial supply from left middle cerebral artery and drainage into thalamostriate veins.

because patient was symptomatic and the hydrocephalus was also present.

## Embolization Procedure

Under general anesthesia, skin overlying right femoral artery was painted and draped with all aseptic precautions. Femoral artery puncture was done with appropriate catheter (5F sheath). On angiography, left common carotid artery with carotid bifurcation was identified. Left internal carotid artery angiogram showed moderate flow left caudate—basal ganglia AVM. Guiding catheter was navigated over guidewire into left internal carotid artery. The guiding catheter was flushed with saline containing heparin. After that microcatheter was passed into one of the big perforators. Once the microcatheter tip was in the desired position, the Onyx was injected as follows: (1) the microcatheter was flushed with

 

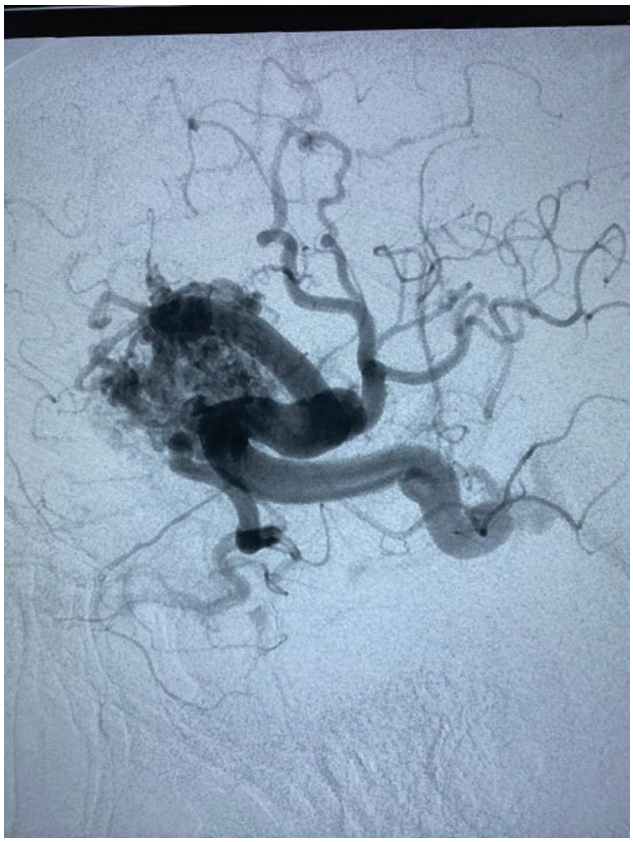

**Fig. 4** Preoperative digital subtraction angiography showing moderate-size left basal ganglia arteriovenous malformation with hypertrophied left middle cerebral artery and drainage into thalamostriate veins with mild cortical venous congestion.

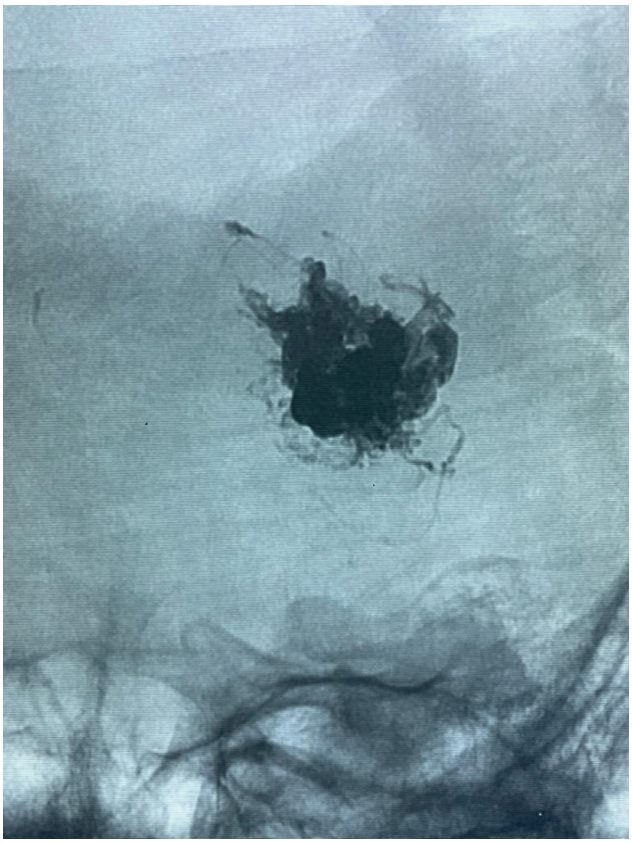

**Fig. 5** Intraoperative image showing embolization done with Onyx in left basal ganglia arteriovenous malformation.

normal saline; (2) Dimethyl Sulfoxide (DMSO) was injected into the microcatheter; (3) Onyx was taken into a 2 mL syringe, and 1 mL was injected slowly for 1 minute; and (4) confirmation of Onyx in vessel was done using fluoroscopy.

After Onyx injections, we also did an angiogram to check nidus occlusion and the blood flow within draining veins (►**Fig. 5**).

After embolization check, angiogram showed approximately 70 to 75% AVM embolization. Other vessels like middle cerebral artery, anterior cerebral artery, and their branches were normal. Venous sinuses were normal. After procedure completed, patient was extubated and shifted to neurosurgery intensive care unit. Computed tomography (CT) brain was done that (►**Fig. 6**) showed reducing hydrocephalus and patient was discharged after 72 hours without any neurological deficit. During follow-up visit after 60 days, CT brain was done and (►**Fig. 7**) it showed significant reduction in hydrocephalus and the patient's vision was improved and papilloedema was regressing. Patient was totally symptom free.

## Discussion

In today's era, treatment of brain AVM includes open surgery, stereotactic radiosurgery, embolization, and combinations of these. Embolization is mainly used to reduce the size of large high-flow deep-seated AVMs, to increase the safety of surgery, or to make the AVM amenable to radiosurgery and to reduce chances of complications of open surgery.[1–4] Previously, the commonly used embolic agent was rapidly polymerizing liquid agent such as *n*-butyl cyanoacrylate (*n*BCA). The use of *n*BCA in brain AVMs requires experience and expertise, because intranidal flow and polymerization of *n*BCA are rapid and highly unpredictable. Nowadays, a new Onyx liquid embolic agent is available that is less adhesive and polymerizes slowly, which has advantage over *n*BCA.[5,6]

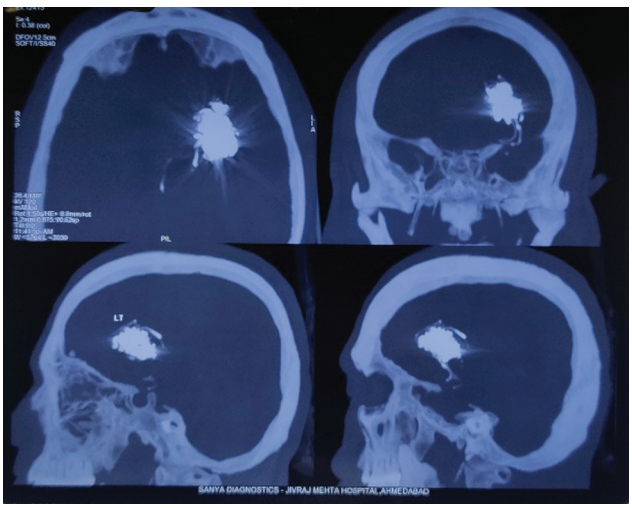


**Fig. 6** Immediate postoperative computed tomography scan showing embolized arteriovenous malformation in left basal ganglia region.

 

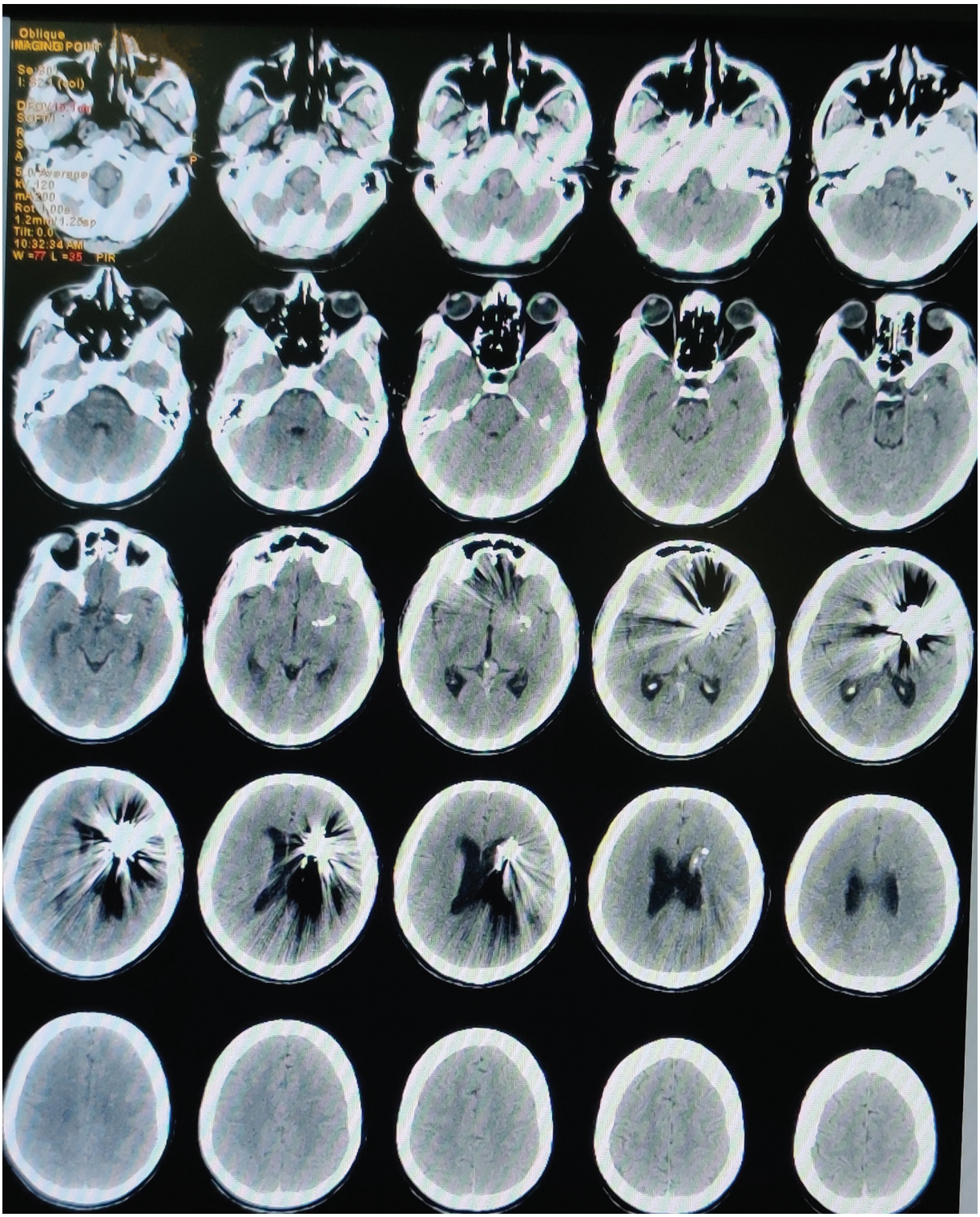


**Fig. 7** Follow-up computed tomography scan after 60 days showing embolized arteriovenous malformation in left basal ganglia region and hydrocephalus also reduced.

In this article, we report our experience with Onyx in the embolization of brain AVMs.

## Result

In this article, we present a case of left basal ganglia AVM in a 40-year-old male who came to us with headache and diminution of vision. In our opinion, diminution of vision in right eye was due to steal phenomenon in right eye and papilloedema, which was due to increase in caliber of thalamostriate vein that was occluding the foramen of Monro. Our experience with the use of Onyx for embolization of brain AVMs is encouraging, with an average size reduction of 75%. Patient was having complete relief from headache and vision was improved in his right eye to

 

hand movement. During follow-up fundoscopy examination showed that papilloedema was regressing. Follow-up CT brain was done that showed there was reducing hydrocephalus and the patient was totally symptoms free.

## Conclusion

Although surgical excision remains gold standard treatment for cerebral AVM, still endovascular treatment is also helpful in certain cases. With endovascular treatment, Onyx is feasible and safe in the embolization of deep-seated brain AVMs. Complete obliteration can be achieved in small AVMs. Large AVMs can be adequately reduced in size for additional surgical or radiosurgical treatment. Selection of case for particular modality of treatment is very important.

Conflict of Interest
None.

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