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Aneurysms of the anterior choroidal artery (AChA) are the most common pathology of the vessel. Although proximal aneurysms at the internal carotid artery (ICA) and AChA junction are common, their occurrence in the distal segment of the anterior choroidal artery (AChA) is quite rare. We report a case of a distal AChA aneurysm occurring in the intraplexal segment of the AChA. To our knowledge, this is the first reported case of an intraplexal distal AChA aneurysm.

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Intraplexal Aneurysm of the Distal Segment of the Anterior Choroidal Artery: A Case Report and Review of Literature

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Abstract

Aneurysms of the anterior choroidal artery (AChA) are the most common pathology of the vessel. Although proximal aneurysms at the internal carotid artery (ICA) and AChA junction are common, their occurrence in the distal segment of the anterior choroidal artery (AChA) is quite rare. We report a case of a distal AChA aneurysm occurring in the intraplexal segment of the AChA. To our knowledge, this is the first reported case of an intraplexal distal AChA aneurysm.

Keywords
Anterior choroidal artery
Aneurysms
BrainPath
internal carotid artery
lateral ventricles
posterior communicating artery
temporal horn

Introduction:

Anterior choroidal artery aneurysms (AchA) are the most common pathology involving the vessel. Proximal aneurysms, at the junction of the internal carotid artery (ICA) and AChA, comprise 2-5% of all intracranial aneurysms; however, aneurysms involving the distal segments, cisternal and intraventricular, of the AChA are highly

infrequent (1). As of 2018, Yu et al. reported that there have been only 40 cases (2). **Additionally, an extensive case series written by Winkler et al. in 2019 reported 146 cases of AchA aneurysms to describe a systematic approach to reduce ischemic complications; none of these cases included post-plexal distal AchA aneurysms, highlighting their rarity (3).** We also conducted a literature search using PubMed and found 4 more cases since 2019 (4,5,6). Due to their relatively small size and deep location, the management of distal AChA aneurysms is challenging. Additionally, there has been no unified approach to the management of such aneurysms. We report a case of a 73-year-old male who presented with intraventricular hemorrhage (IVH). The patient was found to have a right intraventricular AChA aneurysm within the choroid plexus of the lateral ventricle. We also review the literature regarding the clinical significance of the AChA and its pathologies.

Case Presentation:

Patient is a 73-year-old male who presented with altered mental status and a Glasgow Coma Scale (GCS) of 7T. The patient was positive for cough and gag reflexes, withdrawal of bilateral lower extremities, and right upper extremity localization. Patient had no response on the left upper extremity. Corneal reflex and pupil reactivity were present on the right and minimal to absent on the left. There was no history of recent trauma. Non-contrast head CT showed extensive intraventricular as well as extraventricular hemorrhage (Figure 1). Head and neck CTA revealed a 5 x 4 x 4 mm lobulated enhancing structure that is associated with a vascular pedicle, shown in Figure 2. CTA also showed multiple intracranial stenoses involving vessels in the anterior and posterior circulation. Right internal carotid DSA revealed an intraplexal

fusiform aneurysm of the right AChA, measuring 3.1 x 2.2 x 3.1 mm, as shown in Figure 3. Critical stenosis and atherosclerotic disease were also noted at the origin of the AChA, rendering the aneurysms non-amenable to endovascular intervention.

The patient underwent a right sided transtemporal transventricular craniotomy with stereotactic navigation and BrainPath deployment. After the identification of the right temporal sulcus, a 50 MM x 11 MM BrainPath was used to access the right temporal horn of the lateral ventricle. Clearing of the intraventricular hematoma revealed the aneurysmal sac and its vascular pedicle. A microvascular doppler was used for confirmation. Two 5 MM Yasargil mini clips were placed to secure the aneurysm. Post operative DSA showed incomplete obliteration and persistent filling of the aneurysm. The patient underwent a second operation and placement of another clip, which was sufficient to achieve complete obliteration (Figure 4). The patient exhibited initial improvement and was extubated two weeks after surgery; however, persistent hydrocephalus and gradual clinical decline ensued. Patient's family declined further interventions and decided to transition patient to palliative care 1 month after surgery.

Discussion:

Anatomy and clinical significance of the anterior choroidal artery:

French physician Vicq d'Azyr was the first to describe the anterior choroidal artery (AChA) in the 1700's. He is also credited for many other significant discoveries, including the locus coeruleus and substantia nigra. The AChA originates from the posterior aspect of C7, also known as the communicating segment, of the ICA. The AChA branches approximately 2-5 mm distal to the origin of posterior communicating

artery (PCoA). A variable number of perforator vessels, ranging from 0-4, arise between the PCoA and the AChA. These vessels supply portions of the mesial temporal lobe laterally, the optic tract medially, and the posterior perforated substance superiorly. The AChA consists of the cisternal segment, averaging 25 mm in length, and the intraventricular segment. The cisternal segment extends from the origin of the vessel to the choroidal fissure. The intraventricular segment is defined as the distal AChA beyond the plexal point, the point at which the AChA enters the lateral ventricle through the choroidal fissure (1,2).

The AChA supplies critical areas of the brain, including the posterior limb of the internal capsule, the medial pallidum, the optic tract, the lateral geniculate nucleus, the medial temporal lobe, and the choroid plexus. For this reason, the clinical significance of the AChA extends far beyond its relatively small size (1).

Pathologies involving the AChA:

The main pathologies involving the AChA are aneurysms, infarcts, and tumors. Infarcts are rare and they are most commonly cardioembolic in origin. Leys et al. showed that most AChA infarcts are due to large vessel disease rather than small, as was previously presumed. Levy et al. showed that embolic occlusion of the ICA was the main mechanism for AChA territory infarcts. Although the AChA forms anastomotic branches with the posterior cerebral artery (PCA) and the posterior choroidal artery, branches that supply the posterior limb of the internal capsule lack such collaterals. For this reason, infarcts involving the AChA can present with contralateral hemiplegia, hemianesthesia, and homonymous hemianopsia without cortical signs, such as aphasia

(1,2,7,8,9). The constellation of these symptoms is also regarded as the anterior choroidal artery syndrome (ACAS), first described by Foix et al. in 1925 (9).

The AChA can serve as a significant feeder for tumors near the lateral ventricles. Involvement of the AChA in choroid plexus papillomas, meningiomas, and intraventricular gliomas have been reported (11,12,13). For this reason, preoperative embolization of the AChA is strongly recommended to facilitate the surgical resection of such tumors. Embolization is carried out distal to the plexal point, as close as possible to the tumor, to minimize risk of ACAS and neurological deficits due to proximal AChA occlusion.

AChA aneurysms at the junction of the ICA and AChA are the most common pathology, and they account for approximately 2-5% of all intracranial aneurysms; however, aneurysms of the distal AChA are extremely rare. Distal aneurysms more commonly occur beyond the plexal point compared to the cisternal segment. Proximal AChA aneurysms share common etiologies with other saccular aneurysms; however, distal AChA aneurysms have been closely associated with moyamoya disease, believed to be the result of vascular stress while serving as collaterals (2).

Management of AChA Aneurysms:

Endovascular embolization and surgical clipping are the main management strategies for AChA aneurysms. Due to the critical brain areas supplied by the AChA, these procedures carry the risk of ischemia and ACAS development. Kim et al. compared the clinical outcomes and procedure associated complications between endovascular coiling and surgical clipping. There was no significant difference in clinical outcomes, although endovascular coiling had lower rates of AChA infarctions (14).

Surgical clipping of intraventricular AChA aneurysms is quite challenging. This can be attributed to the small operative corridor, the proximity to critical brain structures, as well as the relatively small vessel size. Additionally, the low incidence of distal intraventricular aneurysms hinders the accumulation of surgical experience. Two surgical approaches have been described in most operated cases of intraventricular AChA aneurysms. The transtemporal transventricular approach as well as the trans-choroidal fissure approach (5,15). To our knowledge, there has been no approaches that deployed BrainPath for intraventricular AChA aneurysm clipping.

Conclusion:

Distal AChA aneurysms are rare. This is the first reported case of an intraplexal distal AChA aneurysm. Although rare, this report emphasizes the significance of considering intraventricular AChA aneurysms as a potential cause of IVH. We also introduced the successful application of BrainPath in distal AChA aneurysmal clipping.

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Figure 1 (A) Extensive intraventricular hemorrhage in the right and left lateral ventricles as well as the third and fourth ventricles (not shown in image). (**B)** Extension of hemorrhage into the right sylvian cistern (red arrow), basal cistern (green arrow), and right ambient cistern (blue arrow).

Figure 2 Coronal **(A)** and axial **(B)** head CTA showing a 5 x 4 x 4 mm lobulated enhancing structure in the right temporal horn with a tiny vascular pedicle.

Figure 3 Right internal carotid DSA revealed an intraplexal fusiform aneurysm of the right AChA, measuring 3.1 x 2.2 x 3.1 mm.

Figure 4 Coronal **(A)** and axial **(B)** head CTA showing clip placement and complete obliteration of the aneurysm.