Case Report

Ruptured Aneurysm At The Origin of The Median Artery of The Corpus Callosum:
Case Report

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Abstract
Median artery of the corpus callosum (MACC) is a rare vascular variation and refers to the median artery of the triplicate A2 segments which supplies branches to the corpus callosum and adjacent cortex. The incidence of MACC in patients with anterior communicating artery (ACoA) aneurysms is rare. Here we describe a case of ruptured aneurysm which arose at the origin of a MACC. A 58-year-old female experienced a sudden headache, nausea and vomiting. The scale of Hunt-Hess was grade II. Computed tomography angiography (CTA) and digital subtraction angiography (DSA) showed an anomalous vessel originating from the ACoA complex. The vessel was identified as MACC. At the origin of the vessel was the fusiform-shaped aneurysm with a dome diameter of approximately 29.8mm x 9.8mm. Four weeks after the onset, a bifrontal craniotomy was performed to clip the aneurysm neck. The patient was discharged on the fifteenth postoperative day without neurological deficits. Post-operative three-month DSA did not find any abnormality. An 11-year follow-up showed that she was in a good condition with Karnofsky performance scale of 90. Since the ACoA complex is liable to vascular anomalies, preoperative and intraoperative care should be taken to identify the presence of anomalies of the ACoA complex to avoid accidental damage or clipping that may contribute to severe neurological deficits.

Keywords: Median artery of the corpus callosum; aneurysm; anterior communicating artery; vascular anomaly

Corpus Kallozumun Medyan Arteri çıkışında rüptüre olmuş Anevrizması: Olgu Sunumu

Özet
Korpus kallozunum medyan arteri (KKMA) korpus kallozum ve komşu kortekse dâller vererek besleyen ender görülen üçlü A2 segmentinin medyan arter olarak adlandırılan bir vasküler değişkenidir. KKMA'nin hastalarda anterior kommunikan arter (ACoA) anevrizması ile birlikte görülme sıklığı enderdir. Burada KKMA çıkışında beliren ve rüptüre olan bir anevrizma olgusu sunmaktayız. Ani beliren başağrısı, bulantu ve kusma ile gelen 58 yaşında bir kadın hasta sunulmaktadır. Hunt-Hess SAK derecelendirmesine göre II olan olgunun Bilgisayarlı Tomografi Anjiografisi (BT-A) ve dijital subtraksiyonlu anjiografisi (DSA) tetkikleri ACoA kopleksinden çıkan anomalik bir damar gösterdi. Bu damar KKMA olarak tanımlandı. Damarnın çıkış yerinde fuziform tarzında uzanan bir anevrizmatik dilatasyon ve takribi 29,8 mm x 9,8 mm boyutlarında bir kesesi vardı. Olaydan 4 ay sonra bifrontal kraniotomi girişimi ile anevrizmanın boyun kısmına klip uygulandı. Hasta 15 gün sonra nörolojik bulgusu olmaksızın taburcu edildi. Üç ay sonra yapılan DSA herhangi bir anormalilik göstermedi. Hastanın 11 yıllık izlem sürecinde Karnofsky skoru 90 olarak saptandı. Ağır nörolojik
INTRODUCTION
Vascular anomalies of the Circle of Willis are commonly associated with aneurysm formation, frequently occurring specifically in the anterior communicating artery (ACoA) complex. Vascular anomalies at this site include ACoA aplasia, duplication of the ACoA, A1 aplasia, an azigos anterior cerebral artery (ACA), and a median artery of the corpus callosum (MACC). MACC is a rare vascular variation when seen angiographically and surgically, and refers to the median artery of the triplicate A2 segments which supplies branches to the corpus callosum and adjacent cortex as well as the septal nuclei and upper portion of the column of the fornix. The incidence of MACC in patients with ACoA aneurysms is relatively rare. Here we describe a case of ruptured aneurysm which arose at the origin of a MACC, an extremely rare vascular anomaly.

CASE PRESENTATION
A 58-year-old female with hypertension and diabetes mellitus suddenly developed a severe headache. She was referred to our department immediately. In the Emergency Ward, she showed no major neurological deficits. Magnetic resonance imaging (MRI) scans confirmed an anomaly next to the cerebral falx. The patient refused further examination and self-treated with an analgesic, as she believed she could bear the headache and live a normal life without further help. However, seven months later she suddenly developed severe headache, nausea and vomiting. On admission she had normal consciousness and presented with a stiff-neck but no other neurological deficits. At that time, the scale of Hunt-Hess was grade II. Computed tomography (CT) demonstrated subarachnoid and intraventricular hemorrhage. A later CT angiography (CTA) showed an anomalous vessel originating from the ACoA complex and passing forward in the interhemispheric fissure between the two companion A2 segments. The anomalous vessel did not supply any of the usual cortical branches, and thus was identified as a MACC. A fusiform-shaped aneurysm was found at the origin of the MACC, and a CTA with a shaded surface display reconstruction clearly revealed the three-dimensional structure of the aneurysm and its relationship to the parent artery, the size and the direction of the sac, the neck, and the ratio of sac to neck. After the examination her level of consciousness deteriorated, she became drowsy and showed right motor weakness. The scale of Hunt-Hess was grade III. In order to relieve the acute intracranial hypertension and drain the intraventricular hemorrhage, we performed an external ventricular drainage. The post-operative period was uneventful. Three weeks later, her general condition was steady. Conventional digital subtraction angiography (DSA) was performed and the result was consistent with the CTA result: at the origin of the vessel was the fusiform-shaped aneurysm arising from the MACC with a dome diameter of approximately 29.8 mm × 9.8 mm. (Fig.2.).

Four weeks after the onset, a bifrontal craniotomy was performed to clip the aneurysm neck, using a cerebral interhemispheric approach. The surgical findings were compatible with the DSA. While it was difficult to identify both A1 and
and A2 segments, the exposure of the aneurysm and its adjacent structures was easy. The aneurysm was directed posteriorly. After both A1 and A2 segments and the MACC were identified, the aneurysm neck was occluded successfully with an aneurysm clip (Aesculap FT610T, Germany), the aneurysm wall was cut open and part of the thrombus was taken out. All major vessels around the aneurysm were found to be free of the clip. Moreover, there was no obvious Heubner's artery in the operative field. The postoperative course was uneventful and the patient was discharged on the fifteenth postoperative day without neurological deficits. Three months after the surgery, she was in good condition and follow-up DSA did not find any abnormality. (Fig.3.) The patient had regular post-operative follow-up. An 11-year follow-up showed that she was in a good condition with Karnofsky performance scale of 90.

**Fig 1:** Pre-operative CT images (A, B) and CTA images (C, D) demonstrating intraventricular hemorrhage and a fusiform-shaped aneurysm at the origin of the MACC.

**Fig 2:** Pre-operative DSA images (A, B, C) demonstrating ruptured aneurysm of the MACC.

**Fig 3:** Post-operative DSA images (A, B, C) demonstrating the follow-up results 3 months post-surgery of the aneurysm of the MACC.
DISCUSSION

It is widely accepted that anatomical variants in the Circle of Willis can be found in almost 60% of DSA cases, some of which are associated with vascular malformations such as aneurysms\(^1\). The ACoA complex is the most frequent site of vascular anomalies in this circle of arteries. Familiarity with the details of anatomical variants in the Circle of Willis is crucial for a neurosurgeon to perform an accurate and successful exploration and avoid complications\(^2\).

ACoA branches can be divided into three subgroups: the hypothalamic and subcallosal arteries, and the MACC. The latter is a common variation of the ACoA complex, which also includes unilateral ACA hypoplasia, multiple vascular channel, fenestration, duplication, and fusion\(^7\). Because the presence of a MACC has a low frequency and possesses a special location and hemodynamics, an aneurysm here is extremely rare. There has been very little published information on such aneurysms; when we submitted the key word “median artery of the corpus callosum aneurysm” in PubMed, only 11 publications were found. In 1985, Shimosegawa et al. reported a case of ruptured MACC aneurysm, which was believed to be the first report\(^6\).

While MACC has been termed the medial ACA, the accessory ACA, the median callosal artery, the superior callosal artery, or the third A2 artery, these various terms are used without clear definition. The mean diameter of MACC at origin is 1.28 mm (range: 0.50-1.97 mm). MACC usually originates from the ACoA as a single trunk, then runs anterosuperiorly to the rostrum, curves around the genu of corpus callosum, and ends in the cingulated gyrus at the level of the body of corpus callosum. During its course, MACC gives rise to perforating branches that run to the rostrum, genu and body of the corpus callosum, and the cingulate gyrus\(^3\).

Hemodynamic alterations can lead to MACC aneurysm formation. In our case, the aneurysm originated from the MACC extremity. The patient had suffered from hypertension and diabetes mellitus for many years, and hemodynamic changes due to these conditions imposed a stress on the extremity of the artery, promoting the development of an aneurysm. Furthermore, the large volume of the aneurysm caused the patient to suffer a chronic headache. When the aneurysm could not bear the flow, it ruptured and the patient had acute intracranial hypertension and an intraventricular hemorrhage. During surgery the aneurysm neck was occluded successfully with a clip, the aneurysm wall was cut open and part of the thrombus was taken out in order to lessen the volume effect.

Successful surgical treatment of aneurysm is based upon complete obliteration of the aneurysmal sac without injury to the associated vessels. Compared to posterior circulation aneurysms, those associated with the ACoA complex are easier to expose. However, the vessel’s branches must be taken into consideration. Treatment of ACoA aneurysms involves the identification of numerous vessels including bilateral A1 segments, ACoA, bilateral recurrent arteries, all hypothalamic perforating arteries, and bilateral A2 segments. Anomalies of the vessels of the ACoA complex are common and the incidence of poor outcome due to surgical trauma is greater for ACoA aneurysms than for other anterior circulation aneurysms\(^8\). Although three-dimensional CTA or rotation DSA provide us with precise data and clear images, neurosurgeons should recognize all major and anomalous vessels, develop a therapeutic strategy and carry out safe clipping of the aneurysm. Possible variations of the vascular system must be considered in developing surgical approaches to aneurysms in this area.
Ruptured aneurysm is usually accompanied by cerebral angiospasm and intraluminal thrombus associated with subarachnoid hemorrhage, and some anatomical anomalies or even details of vessels are frequently not disclosed. Therefore, direct visualization of the ACoA complex via an operative microscope is necessary to identify and preserve these vital structures before clip application. Intraoperative angiography may prevent inadvertent clip occlusion of MACC and other vital vessels, although this technology is costly, prolongs operation time and can only be carried out in a few medical institutions.

CONCLUSION

Even when a vascular variation has not been specifically identified preoperatively, ACoA aneurysm surgery should be undertaken with the consideration that a MACC may exist. The ability to recognize anatomic variations of the ACoA and detailed knowledge of the microvascular relationships of aneurysms will enable neurosurgeons to make a better and safer microdissection plan. They will thus be able to develop the most suitable operative approach, to save operation time and prevent postoperative neurological deficits.

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REFERENCES


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