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Intracranial aneurysms - a battle against time

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cerebral aneurysm, intracranial haemorrhage, microsurgical clipping, neurosurgery

ABSTRACT

Introduction: Intracranial aneurysms consist in abnormal dilatation of the cerebral arteries, most frequently asymptomatic, with symptoms appearing in the case of aneurysm rupture. From an imaging point of view, a cranial CT scan shows the subarachnoid haemorrhage caused by aneurysm rupture and the "gold standard" for aneurysm diagnosis is cerebral angiography.

Case presentation: A 49 years-old female, Ukrainian refugee, presented with a unique comitial crisis and chronic headache. Following an MRI performed in Kiev, it was decided to perform a bilateral carotid and vertebral angiography in our clinic. Clinical and imagistic results showed a giant left middle cerebral artery aneurysm. Postoperative, the patient had a favourable neurological recovery, with no neurological deficits. Additionally, control angiography and CT scan highlight complete occlusion of the aneurysm and no complications.

Conclusions: Cerebral aneurysms represent a high-risk vascular condition that needs a CT scan and angiography to be precisely diagnosed, surgical clipping should be performed as soon as possible.

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INTRODUCTION

Cerebral aneurysms are abnormal dilatation of the cerebral arteries, which are developing because of pre-existent defects of the arterial wall. Usually, cerebral aneurysms are asymptomatic, becoming symptomatic in case of rupture of the aneurysm, leading to clinical signs suggestive for subarachnoid hemorrhage, or in case of excessive aneurysmal volume growth, it can cause a mass effect on the cerebral parenchyma. Main signs and symptoms are intense headache (described by patient as being the fastest headache of their life), neck

pain, vomiting, dizziness, photophobia, motor deficit, focal deficits of cranial nerves etc.
An essential aspect is clinical manifestation from subarachnoid hemorrhage which can be caused by rupture of a cerebral aneurysm. For definite diagnosis we need radiological imaging, such as cerebral CT, to accurately identify the subarachnoid hemorrhage. Moreover, if subarachnoid hemorrhage diagnosis will be confirmed, a cerebral angiography is indicated for definite identification of the lesion and cause of haemorrhage.

Neuroimaging diagnosis

Necessary neuroimaging investigations are:
Computed tomography (CT) - mandatory exam for any subarachnoid hemorrhage. Hemorrhage appears hyperdense. A scale that helps us in CT scan examination of the patient is Fisher Scale (1980). [1]
Cerebral Angiography - represents the next step in imaging investigation and stands as the "gold standard" for aneurysms identification. After angiography, we can diagnose the cerebral aneurysm, and also identify the aneurysmal parent artery. A control angiography is necessary after surgery to verify the success of neurosurgical occlusion of the aneurysm.

Case presentation

Female patient, 49 years old, Ukrainian refugee, was admitted to The National Institute of Neurology and Neurovascular Diseases, Bucharest, Romania for comitial crisis and chronic headache with evolution in last years and increased frequency of crisis in the last months. Neurological evaluation revealed Grand Mal type comitial crisis and elements of expressive aphasia. The patient presented with a native head MRI performed in Kiev. MRI shows a round-oval structure, of 3/2 cm located at middle cerebral artery bifurcation on the left side, hypointense in T1 and hyperintense in T2, in contact with left sylvian artery suggestive for a giant aneurysm of left middle cerebral artery. The rest of MRI shows normal aspect of the brain in T1 and T2 sequences.

A bilateral carotid and vertebral angiography was performed, which highlighted a giant saccular aneurysm inserted at the medial cerebral artery bifurcation on the left side, with antero-inferior orientation, with a maximum diameter of 1,6 cm and neck of approximately 7 mm. No other abnormal modifications were observed.

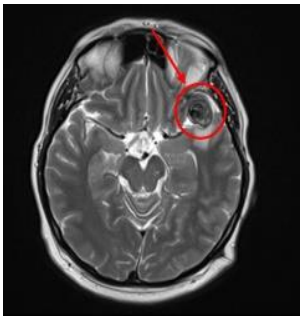


Figure 1. MRI T2 sequence

Figure 2. MRI FLAIR sequence

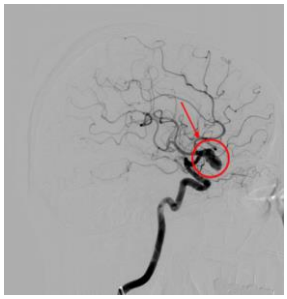
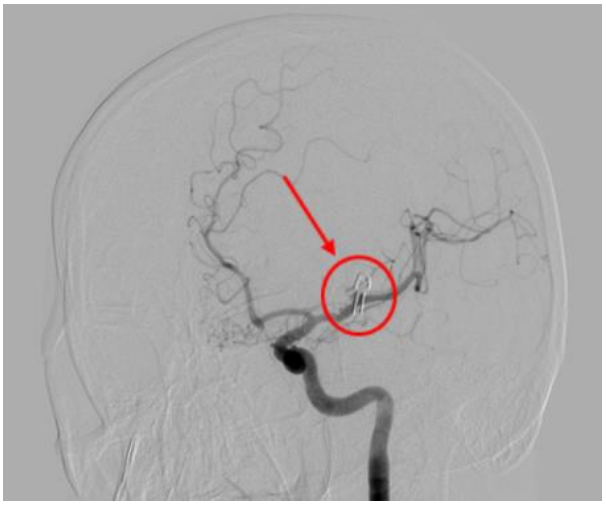


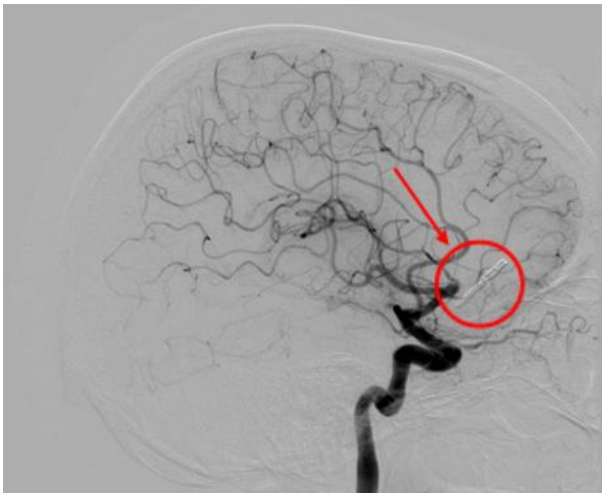
Figure 3. Left carotid angiography, profile incidence.
Figure 4. Left carotid angiography, anteroposterior incidence.

Surgery was performed and clipping of the giant left middle cerebral artery aneurysm with a maximum diameter of approximative 3,5 cm and neck of approximative 10 mm, was performed. The aneurysm required opening and evacuation of intraluminal thrombus under temporary clipping before fixing the definitive clip. Postoperatively, evolution was favorable with no complications.

Figure 5. Incision place – postoperatively.
Figure 6. Standing patient

Control left carotid angiography highlights clipping of the aneurysm at neck level and preservation of both branches of the left middle cerebral artery.





Figures 7,8. Control angiography

Postoperative native cerebral CT scan, revealed correct positioning of the clip at left sylvian cistern level and a hypodense area with ischemic aspect at left frontal lobe.

Figure 9. Control cerebral CT-scan

The patient was discharged 7 days after the surgery, neurological examination at discharge revealed no neurological deficits (normal motor function, normal speech, normal cranial nerve's function). Rankin Scale at discharge was 0.

Discussions

Intracranial aneurysms are a result of abnormalities to the normal arterial vessel structure, usually from collagen deficiency in the internal elastic lamina, situated between the tunica intima and the tunica media (the muscle middle layer) of the arterial vessel. The most common presentation is subarachnoid hemorrhage, which can be seen from a CT scan, which raises the suspicion of a cerebral aneurysm, angiography showing exactly the aneurysm localization, morphology and dimensions. The surgical management of aneurysm has been debated over time, according to the literature, microsurgical clipping should be used in cases of aneurysm rupture, as in our case, while coil embolization remains recommended in non-ruptured aneurysm. Choosing between microsurgery or endovascular treatment in cases of unruptured aneurysm, the risk-benefit ratio should be taken into consideration and the final decision will be made together with the patient. [2]

Pseudotumoral giant aneurysms represent a rare aneurysm presentation and can simulate a neoplasm, as explained in a study from W. Wijethunga et al. (2018) of a intracavernous aneurysm that clinically and imaging simulated a pituitary macroadenoma. Due to the multilayered and "halo" appearance of the lesion on MRI, a CT angiogram was performed, which revealed a large aneurysm from the cavernous portion of the left internal carotid artery. This article shows the necessity of angiography for a correct diagnosis of an aneurysm, since heterogeneity present on an MRI can direct the diagnosis to other pathologies, such as tumors. [3]

E. Kalin-Hajdu et al. (2011) presented a unruptured fusiform aneurysm of middle cerebral artery, which underwent spontaneous occlusion and regression. Angiography indicates a pseudotumoral-like mass, supposedly from inflammation and neovascularization within the aneurysm wall and body. Inflammation and neovascularization is associated with giant cerebral aneurysms and intramural hemorrhage. Before embolization,

angiography revealed complete spontaneous thrombosis of the aneurysm. Due to this event, endovascular treatment was not necessary anymore. The patient presented at 11 months follow up and the MRI revealed near complete regression. Those spontaneous healing mechanisms are currently unknown, but they're probably explained by theory of inflammation and secondary neovascularization. [4]

In another case presentation, O. Doron et al. (2016) described a giant partially thrombosed left carotid-ophthalmic aneurysm with a bone erosion of the sphenoid sinus, re-shaping the intracranial micro-environment. Bone erosion was correlated with giant aneurysm and has multiple implications regarding pre-surgical planning. Clipping was performed due to the optic nerve and chiasm relations and excision of the thrombosed part, as in our aforementioned case. From this case report, multiple theories were proposed for the evolution of a giant thrombosed aneurysm. First of all, repeated endothelial damage caused by turbulent flow and healing can significantly enlarge the aneurysm dimensions through an inflammatory cascade. Secondly, a slow growth can be determined from recurrent hemorrhages. So, the understanding of thrombosed aneurysm evolution is becoming more clear in the last years, helping with pre-surgical management and being ready for spontaneous structural modifications. [5]

Conclusions

Cerebral aneurysms are vascular lesions which can endanger the patient's life when they rupture. Intracranial hemorrhage can significantly affect nervous cells` metabolism and the patient state of consciousness, explaining the clinical presentation. Additionally, the hemorrhage can fill the basal cisterns and ventricles, altering the state of conscience. Emergency hospitalization is mandatory for a complete clinical and imaging evaluation; surgical intervention needs to be performed as soon as possible.

Regarding our case of a large, thrombosed aneurysm, due to the aneurysm nature, endovascular embolization cannot be achieved, and the treatment of choice will be surgical approach. Before clipping, thrombus evacuation under temporary clipping is necessary for a complete and long-term occlusion of the aneurysm. Additionally, the real dimensions of the aneurysm can only be seen intraoperatively, during microscopic inspection, because the contrast agent from angiography will not enter completely into the aneurysm body.

In cases of non-ruptured and asymptomatic aneurysm, deciding between microsurgical clipping and endovascular embolization should be made by a well-informed patient. In a few of those cases, conservative treatment will be taken into consideration to avoid surgical interventions and possible postoperative complications. Thus, neurosurgeons have the obligation to correctly inform the patient about different surgical procedures and their alternatives.

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