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Assessment of risk factors in *de novo* aneurysm development

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Abstract:

Aneurysms that occur anywhere in intracranial except where primary aneurysms develop, are called “*de novo* aneurysms”. The risk factors and formation time of *de novo* aneurysms are not fully known. Congenital, environmental and hemodynamic factors can play a role in aneurysm development. The 43-year-old female patient was operated with the middle cerebral artery superior trunk aneurysm in our clinic. She came to us again after 17 months with a severe headache. In computed cranial tomography angiography, the middle cerebral artery superior trunk placement aneurysm was found to have a partial clip and “*de novo* aneurysm” was developed. She was re-operated for “*de novo* aneurysm”. In this study, the risk factors in development of “*de novo* aneurysms” were discussed in the light of literature through this patient.

Keywords:

De novo aneurysm, microsurgery, risk factors

Introduction

Spontaneous subarachnoid hemorrhage (SAH) is a serious complication that develops after intracranial aneurysm (IA) rupture. The prevalence of IAs is reported as 1%–5%.^[1] In a small number of patients with IA, a second aneurysm may develop except the primary localization. This second aneurysm is called the “*de novo* aneurysm.” In the literature, “*de novo* aneurysm” was first reported by Graf and Hamby.^[2]

Risk factors and formation time of *de novo* aneurysms are not fully known. Therefore, there is no accepted follow-up protocol for the determination of “*de novo* aneurysm” development. After the aneurysm treatment, it is difficult to determine which patients need aggressive surveillance in terms of “*de novo* aneurysm” development.^[1,3] The aim of this study is to discuss the risk factors in the development of “*de novo* aneurysm” in light of literature.

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Case Report

A 43-year-old female patient, who was presented to the emergency department with headache and unconsciousness, was diagnosed with SAH in the right sylvian localization in computed cranial tomography (CCT). After a digital subtraction angiography (DSA), superior trunk aneurysm of the middle cerebral artery (MCA) [Figure 1] was seen to be the cause of hemorrhage. Fisher grade was 1, Glasgow coma score (GCS) was 14, and Hunt–Hess grade was 2. After the right pterional craniotomy, the aneurysm was clipped. She came to us again after 17 months with a severe headache complaint. GCS and Hunt–Hess grade of her were 15 and 1. SAH was not observed in CCT. In CCT angiography, the MCA superior trunk placement aneurysm was found to have a partial clip and *de novo* aneurysm was developed on the right M1 [Figure 2]. The *de novo* aneurysm on the M1 was clipped from the right pterional old craniotomy. Then, MCA superior trunk aneurysm, which was a partial clip, was explored and total obliterated. The patient was discharged without any postoperative deficit. No new

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aneurysm and vascular pathology were observed in the CCT angiography of the patient, a year after the last operation [Figure 3].

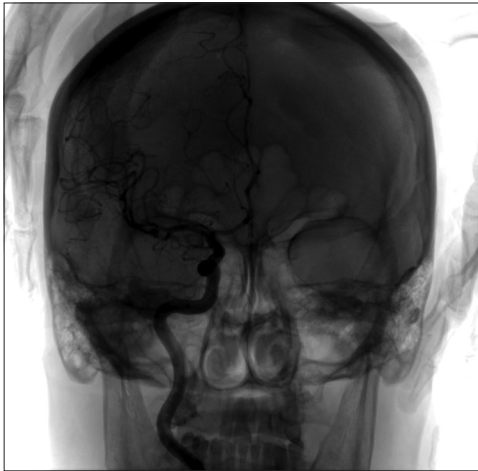


Figure 1: Superior trunk aneurysm of middle cerebral artery

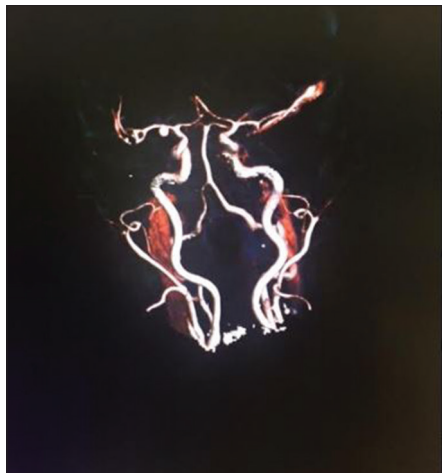


Figure 2: De novo aneurysm on the right M1

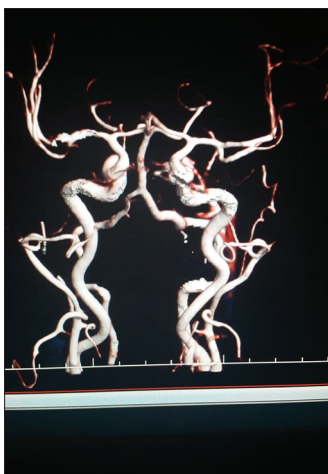


Figure 3: Computed cranial tomography angiography image after last operation

Discussion

In the literature, the risk of developing a “*de novo* aneurysm” after the diagnosis of primary aneurysm is reported to be between 0.37% and 4.15% for each year.^[4,5] In conducted studies, *de novo* aneurysm formation was spotted between 3 and 15 years after the first aneurysm was identified.^[3,5-9] Congenital, environmental, and hemodynamic factors play a role in aneurysm development.^[4] In the development of *de novo* aneurysms, as in our case, female gender and smoking are particularly among the reported risk factors.^[4,10] Smoking has been stated as a risk factor for *de novo* aneurysm formation, as it may cause elastase and alpha antitrypsin imbalance, and therefore, it may increase the effect of hemodynamic stress on the vascular wall.^[11,12] In our case, there was more than one pack of cigarettes per day before and after the first operation. A study by Kemp *et al.* that evaluated the risk factors for *de novo* aneurysm development showed that 37.8% of the patients had hypertension and the presence of hypertension was also reported as a risk factor.^[4] Again, our case was receiving medical treatment for hypertension. There is no statistically significant difference between the ruptured or unruptured aneurysm patients in *de novo* aneurysm formation.^[3] Although she had headache, and SAH was diagnosed in the first aneurysm, SAH was not observed during the diagnosis of “*de novo* aneurysm.” In the meta-analysis carried out by Giordan *et al.*, *de novo* aneurysms were mostly (>80%) detected during follow-up for more than 5 years.^[3] Our case was detected in the imaging performed as a result of severe headache 17 months after the first aneurysm operation. In the same study, Kemp *et al.* found that there were no statistically significant differences in “*de novo* aneurysm” hemorrhage between hypertension, diabetes mellitus, tobacco-alcohol usage, polycystic kidney disease, and previous history of SAH.^[4]

Other risk factors including radiation exposure, familial aneurysm history, presence of multiple aneurysms at the time of initial diagnosis, and young age (<40 years) have been reported.^[1,4,13] These risk factors were not present, in our case. In a meta-analysis by Hu *et al.*, the appearance of the first aneurysm in internal carotid artery localization has been reported as another risk factor.^[1] In our case, the “*de novo* aneurysm” was developed in the proximal MCA (M1), although the first aneurysm was in the MCA superior trunk. Hemodynamic changes have also been shown to have a major impact on the development of *de novo* aneurysms.^[14] *De novo* aneurysms, due to changes in blood flow after carotid artery occlusion, are very well documented.^[4,15] Partial clipping of the first aneurysm in our case may have caused hemodynamic changes.

Perhaps, as Koeleveld *et al.* indicated, *de novo* aneurysms are actually a special case of multiple aneurysms.^[16] Many studies deem that aneurysm scans are ineffective because they can be of high cost.^[17-21] In the meta-analysis conducted by Giordan *et al.*, it was thought that the screening could be done in a span of 5–10 years.^[3] However, as highlighted it in our study, we reckon that there might be *de novo* aneurysms occurring in the early period and the controls should be annual due to the high mortality rate in case of bleeding.

Conclusion

Risk factors for *de novo* aneurysm development can be reported as young age, female gender, smoking, radiation exposure, familial history of aneurysms, hypertension, and multiple aneurysms. However, there was no statistically significant correlation between these risk factors and *de novo* aneurysm hemorrhage. In symptomatic patients who have had an aneurysm operation previously and have these risk factors, magnetic resonance imaging angiography, CCT angiography, and DSA should be performed even if there is no SAH on CCT.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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