

Anterior cerebral artery aneurysm associated with multiple intracranial aneurysms and abdominal aorta aneurysm

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Abstract: We found multiple aneurysms in the intracranial arteries and abdominal aorta of an 87-year-old Korean female cadaver, whose cause of death was reported as "cholangiocarcinoma." An abdominal aortic aneurysm was observed in the infrarenal aorta, where the inferior mesenteric artery arose. The intracranial aneurysms were found in the A3 segment of the anterior cerebral artery and at the bifurcation of the middle cerebral artery. This case provides an example of the very rare association of peripheral intracranial aneurysms with an abdominal aortic aneurysm. Clinicians as well as anatomists should recognize the potential association between these two aneurysm types.

Key words: Abdominal aorta, Aneurysm, Anterior cerebral artery, Korean cadaver

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Introduction

Aneurysms occur most commonly in the cerebral arteries and the aorta as an intracranial saccular aneurysm (IA) and an abdominal aortic aneurysm (AAA), respectively [1, 2]. IAs occur in or near the circle of Willis, and AAA occurs in the infrarenal aorta. IAs affect approximately 3.2% of the general population [3], and AAA affects 6-8% of people of advanced age [4]. There are similarities and differences in the development of the aneurysmal types, and the association between IAs and AAA has rarely been reported. Norrgård et al. [5] had reported that only 0.6% of patients with intracranial aneurysms had associated AAA, and only 2.2% of patients with an AAA had associated intracranial aneurysms. A recent report by Miyazawa et al. [6], using more advanced diagnostic modalities, found that the incidence of

this association was 7.2%. Unlike most IAs, aneurysms that occur in the arteries besides those in the circle of Willis are called peripheral cerebral aneurysms [7]. These aneurysms are usually distal to the anterior communicating artery on the A2-A5 segments of the anterior cerebral artery (ACA); they account for only 6% of all IAs [8]. This case demonstrates the simultaneous existence of multiple aneurysms in the A3 segment of the ACA, bifurcation of the middle cerebral artery (MCA), and the abdominal aorta in a Korean female cadaver.

Case Report

During a routine dissection at Jeju National University Medical School in 2012, multiple aneurysms were observed in the intracranial arteries and abdominal aorta of an 87-year-old female Korean cadaver, whose cause of death was listed as "cholangiocarcinoma." The protocol for the current report did not include any specific issue that required the approval of the ethics committee of our institution, and it conformed to the provisions of the Declaration of Helsinki in 1995.

Gross dissection was performed in the customary fashion. During dissection, an aneurysm was observed in the

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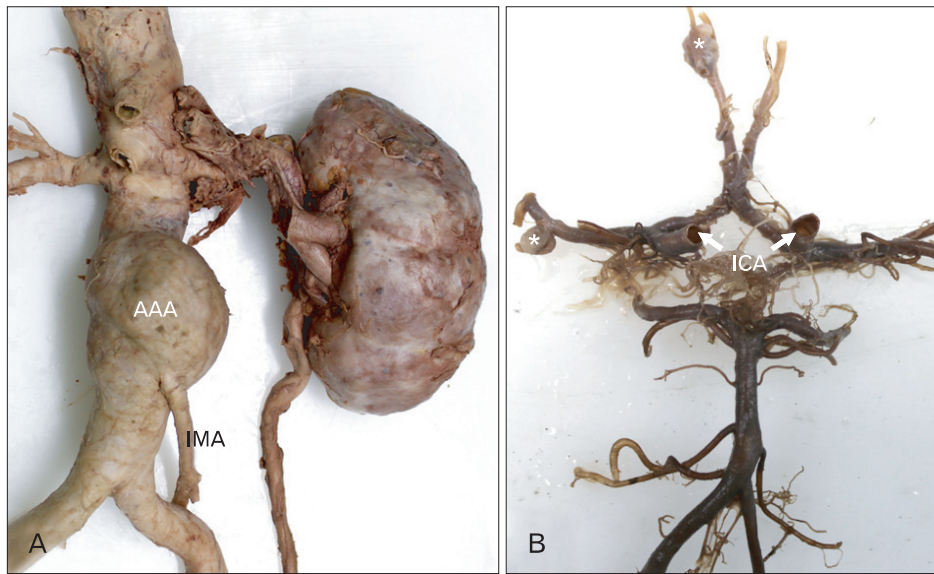


Fig. 1. Photographs of the abdominal aortic aneurysm (AAA) (A) and intracranial artery aneurysms (B) in the A3 segment of anterior cerebral artery and bifurcation of the middle cerebral artery (asterisks). ICA, internal carotid artery; IMA, inferior mesenteric artery.

infrarenal aorta, 19.1 mm superior to its bifurcation into the common iliac arteries. The size of the AAA was 46.5×40.6×36.7 mm where the inferior mesenteric artery arose (Fig. 1A). In longitudinal section, atherosclerotic thickening was observed.

After removal of the brain, we found multiple aneurysms in the intracranial arteries (Fig. 1B); one aneurysm was located in the A3 segment of the ACA and another at the bifurcation of the MCA. A distal ACA aneurysm was located on the central part of the A3 segment, anterior to the genu of corpus callosum, 18.0 mm distal to the anterior communicating artery. The aneurysm was a small berry-type aneurysm, with a size of 6.8×5.5×3.7 mm. The aneurysm at the bifurcation of the MCA was located 13.5 mm distal to the bifurcation of the internal carotid artery (ICA) into the ACA and MCA. The aneurysm was a small saccular-type aneurysm with a size of 4.3×2.8×3.2 mm.

Discussion

The random simultaneous occurrence of IAs and AAA would happen by chance in only 0.2% of the population, and the estimate is considerably lower for the simultaneous occurrence of ACA aneurysms and an AAA. We found the simultaneous existence of multiple aneurysms in the A3 segment of the ACA, the MCA bifurcation, and the abdominal aorta in a Korean female cadaver during a routine dissection course. A distal ACA aneurysm, located distal to the anterior communicating artery, is known to have the

following features [8]: 1) The A3 segment is the most frequent location, anterior or inferior to the genu of corpus callosum, and 2) It is associated with multiple aneurysms, most frequently at the bifurcation of the MCA. The distal ACA aneurysms, in this case, had the typical anatomic features previously reported, with the addition of an associated AAA.

Until 2007, only 25 patients, 21 men and 4 women, have been reported to have coexisting IAs and AAA [6]. According to this study, the aneurysms were located in the ICA in 17 cases, the MCA in 7 cases, the anterior communicating artery in 6 cases, the ACA in 2 cases, the basilar artery in 2 cases, the posterior cerebral artery in 2 cases, and the superior cerebellar artery in 1 case. Eleven patients had multiple intracranial aneurysms; however, only 3 patients underwent autopsy. Recently, Norimatsu et al. [9] described an AAA, which was associated with an aneurysm at the bifurcation of the MCA and presented as a complication of polycystic kidney disease. The prevalence of IAs is higher in patients with polycystic kidney disease and in those with a family history of IAs or subarachnoid hemorrhage than in people without comorbidity, when adjusted with sex and age [3].

The authors report this case because the aneurysms were very rarely localized in comparison to other cases. In this case, the aneurysms were observed in the abdominal aorta as well as in the intracranial arteries on the A3 segment of the ACA and at the bifurcation of the MCA. A previous report [10] suggested that coexistence of dissecting aneurysms in the ACA and abdominal aorta was related to the pathological findings of medial degenerative changes

with the accumulation of acid mucopolysaccharides. IAs and AAA, however, result from different underlying disease processes, and thus have different risk factors [2]. The etiology of brain aneurysms is still controversial, but the following should be considered: congenital defects in the wall of a blood vessel, atherosclerotic changes, trauma, neoplasm, or infectious emboli [11]. As the loss of estrogen, especially in postmenopausal female patients, is a risk factor for the development of cerebral aneurysms [12, 13], risk factors for multiple IAs (15–30%) include female sex, advanced age, and hypertension [14]. Decreased estrogen levels in menopausal women may contribute to the pathogenesis of AAA [15]. The risk for both IAs and aortic aneurysms is thought to be heritable, in association with chromosomes 11 and 6, a finding that warrants further investigation [16]. Another genetic variant on chromosome 9p21, with changes in the extracellular matrix, was associated with IA, but not with AAA [1]. In addition, smoking and hypertension might be considered risk factors common to both aneurysm types [1]. Of the above factors, the present case had in common advanced age and female gender, indicating menopausal state. This report might provide the grounds for a study with a larger clinical cohort to provide better insight into the gender-specific risk for multiple aneurysms and diseases associations.

In conclusion, we found a very rare case of distal ACA aneurysm associated with multiple IAs and with an AAA in an elderly female cadaver. Although the association between IAs and AAA is very uncommon, patients with distal ACA aneurysms should be screened for multiple aneurysms with various diagnostic modalities.

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