



Rupture of an intracerebral aneurysm after carotid endarterectomy: a case report

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Abstract

Coincidental intracerebral aneurysm and internal carotid artery stenosis is a rare combination. This case report describes the development of an intracerebral aneurysm in the presence of an internal carotid artery stenosis in an 58-year old women. Furthermore, the management of intracerebral aneurysm in combination with an internal carotid artery stenosis is discussed as well as the role of potential important hemodynamic factors involved in the development and rupture of these aneurysms.

Key words: Intracerebral; aneurysm; carotid; stenosis; endarterectomy; hemodynamic; development.

Introduction

A number of congenital and degenerative factors are thought to be involved in the pathogenesis of cerebral aneurysms. Among these, hemodynamic stress plays an important role (Spallone and Cantore, 1981). Increased pressure in the intracranial vessels during a prolonged period of time may result in degenerative changes in the elastic intimal membranes and ultimately in the formation of aneurysms. Although there is experimental evidence in favour for this pathogenesis, clinical studies are limited. We had the unique opportunity to observe a patient who developed an anterior communicating artery aneurysm in a period of 7 years following stenosis of the right internal carotid artery and occlusion of the left internal carotid artery. After right-sided carotid endarterectomy (CE) rupture of the aneurysm occurred.

Case report

A 58-year-old women was referred to the hospital because of a sudden collapse. Seven years before,

this patient was seen in the hospital because of transient left sided paresis. A duplex scan of the carotid arteries showed a complete stenosis of the left internal carotid artery and a stenosis of 50-80% of the right internal carotid artery. She was a heavy smoker and known with hypertension. Carotid angiography disclosed an occlusion of the left internal carotid artery (Fig. 1), furthermore a non-significant stenosis of the right internal carotid artery (< 50%). Cerebral vessels showed no abnormality. Five years later, the patient had noted several periods of blurred vision of the left eye during 30 minutes but also for a period of 45 minutes a weakness of the left hand. The duplex scan of the carotid arteries was unchanged. On her request the patient was referred to another hospital for a second opinion, however the treatment strategy remained unchanged until a year later. She was then again seen because of renewed complaints of amaurosis fugax of the left eye. Although duplex scan investigations of the carotid arteries remained unchanged, a right-sided carotid endarterectomy was performed. Ten days after this procedure, the patient suddenly collapsed and complained of severe headache. Computed tomography showed extensive subarachnoid hemorrhage in the basal cisterns and third ventricle. Cerebral angiography and magnetic resonance angiography demonstrated a communicating anterior aneurysm of 6 mm on the right side (Fig. 2). The aneurysm was subsequently clipped and the patient made a good clinical recovery.

Discussion

Although seldom, the combination of internal carotid stenosis and an intracerebral aneurysm is described in several reports. Estimates of the incidence of this condition varies from 0.5 to 5% of patients (Dippel *et al.*, 1994; Griffiths *et al.*, 1996; Pappada *et al.*, 1996; Kappelle *et al.*, 2000; Navaneethan *et*

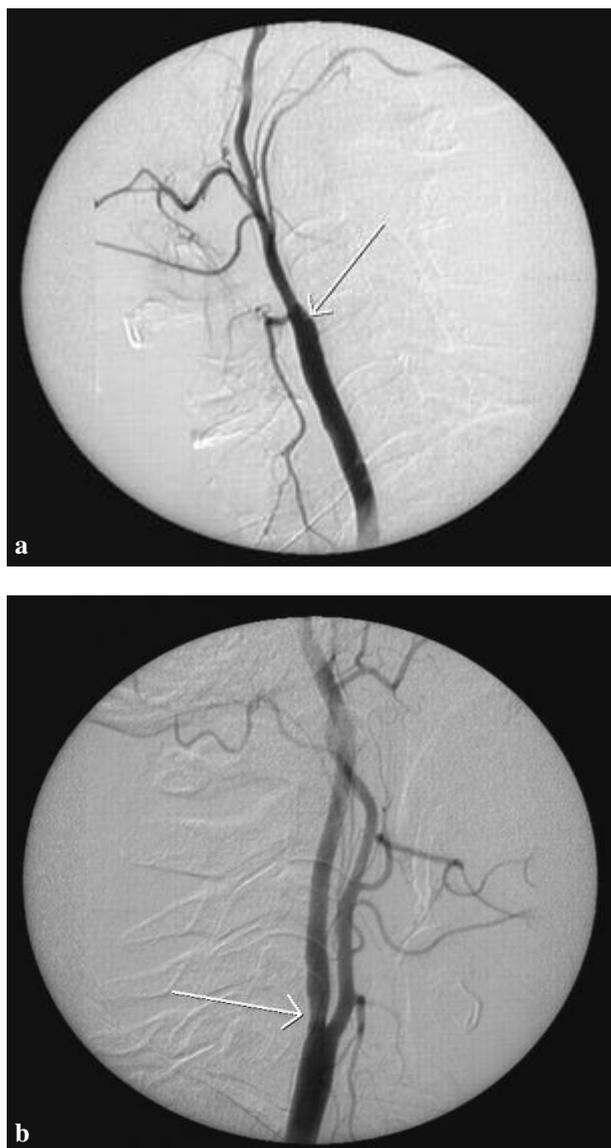


FIG. 1. — Carotid angiography performed in 1993 showing a) occlusion of the left internal carotid artery, b) stenosis of the right carotid artery..

al., 2006; Héman *et al.*, 2009). In our patient, the existence of the aneurysm was not demonstrated before CE surgery. However, usually intracerebral aneurysms in combination with carotid artery stenosis are detected during angiographic procedures for stenosis and are still asymptomatic. Once an aneurysm has ruptured, it is generally recommended that the aneurysm should be treated before the endarterectomy is performed (Porter *et al.*, 1997). The management of unruptured aneurysms in association with a significant internal carotid stenosis is still subject for discussion and the risk of rupture



FIG. 2. — Cerebral angiography performed in 2001 demonstrating a communicans anterior aneurysm on the right site.

against the risk of aneurysm surgery, stroke, and endarterectomy has to be considered. Several authors recommend that CE can be done with minimal risk if the aneurysm is small, ie < 6 mm (Kann *et al.*, 1997) or < 10 mm (Kappelle *et al.*, 2000). In larger aneurysms, it is advised to make decisions on individual basis (Kappelle *et al.*, 2000; Navaneethan *et al.*, 2006; Kann *et al.*, 1997). In contrast, Ballotta (2006) postulates that detection of any aneurysm does not influence the decision of performing of a CE. Héman (2009) concludes that there are no reliable data that carotid revascularisation increases the rupture risk of intracranial aneurysms. However, the clinical course of our patient clearly suggests that there is a potential risk of rupture of the aneurysm in these patients after a CE procedure. Therefore, we believe that in these cases, treatment of the aneurysm before CE should be seriously considered.

In the pathogenesis of aneurysms several mechanisms are thought to be involved. Apart from congenital vascular disturbances, many investigators have suggested an important role for hemodynamic forces in the development of aneurysms (Fujiwara *et al.*, 1993; Senn *et al.*, 2000; Briganti *et al.*, 2002; Wang *et al.*, 2008). The fact that one of the most important risk factors of aneurysms is hypertension is in accordance with this assumption (Obay *et al.*, 2003). In our patient the first angiography did not show any aneurysmatic abnormalities but the second angiography 6 years later clearly showed an aneurysm of the anterior communicating artery. It

might be hypothesized that continued increased pressure in the right internal carotid artery and anterior communicating artery due to occlusion of the opposite side resulted in aneurysmatic dilatation of the anterior communicating artery. In this regard, it has been shown that reconstruction of an artery with 50% stenosis can increase blood flow by an average of 40% and thus it is likely that the sudden increase in blood flow after the CE in our patient might have resulted in the rupture of the aneurysm (Shumann *et al.*, 1996).

In conclusion, this case report demonstrates the importance of hemodynamic factors in the development of cerebral aneurysms in patients with vascular risk factors. Moreover, the significance of an adequate carotid angiography together with illustration of the intracerebral vasculature is stressed to detect cerebral aneurysms. This case report demonstrates also that small aneurysms have a risk of rupture after an carotid endarterectomy.

REFERENCES

- Ballotta E, Da Giau G, Mantara R, Baracchini C. Extracranial severe carotid stenosis and incidental intracranial aneurysms. *Ann Vasc Surg.* 2006; 20:5-8.
- Briganti F, Cirillo S, Caranci F, Esposito F, Maiuri F. Development of "de novo" aneurysms following endovascular procedures. *Neuroradiology.* 2002;44: 604-609.
- Dippel DWJ, Vermeulen M, Braakman R, Habbema JDF. Transient ischemic attacks, carotid stenosis, and an incidental intracranial aneurysm. A decision analysis. *Neurosurgery.* 1994;34:449-458.
- Fujiwara SH, Fujii K, Fukui M. De novo aneurysm formation and aneurysm growth following therapeutic carotid occlusion for intracranial internal carotid artery (ICA) aneurysms. *Acta Neurochir.* 1993;120: 20-25.
- Griffiths PD, Worthy S, Gholkar A. Incidental intracranial vascular pathology in patients investigated for carotid stenosis. *Neuroradiology.* 1996;38:25-30.
- Héman L. M, Jongen LM, Van Der Worp HB, Rinkel GJE, Hendrikse J. Incidental intracranial aneurysms in patients with internal carotid artery stenosis. *Stroke.* 2009;40:1341-1346.
- Kann BR, Matsumoto T, Kerstein MD. Safety of carotid endarterectomy associated with small intracranial aneurysms. *South Med J.* 1997;90:1213-1216.
- Kappelle LJ, Eliasziw M, Fox AJ, Barnett HJM. Small, unruptured intracranial aneurysms and management of symptomatic carotid artery stenosis. *Neurology.* 2000;55:307-309.
- Navaneethan SD, Kannan VS, Osowo A, Shrivastava R, Singh S. Concomitant intracranial aneurysm and carotid artery stenosis: a therapeutic dilemma. *South Med J.* 2006;99:757-758.
- Obayr R, Clatterbruck R, Olvi A, Tamargo R, Murphy KJ. *et al.* De novo aneurysm formation 6 and 22 months after initial presentation in two patients. *AJNR Am J Neuroradiol.* 2003;24:1811-1813.
- Pappada G, Fiori L, Marina R, Vaiani S, Gaina SM. Management of symptomatic carotid stenoses with coincidental intracranial aneurysms. *Acta Neurochir.* 1996;138:1386-1390.
- Porter RW, Lawton MT, Hamilton MG, Spetzler RF. Concurrent aneurysm rupture and thrombosis of high grade internal carotid artery stenosis: report of two cases. *Surg Neurol.* 1997;47:532-540.
- Senn P, Krauss JK, Remonda L, Nelson G, Schroth G. The formation and regression of a flow-related cerebral artery aneurysm. *Clin Neurol Neurosurg.* 2000; 102:168-172.
- Shumann MU, Mirzai SH, Samii M, Vorkapic P. Xenon/CT CBF measurements as valuable diagnostic tool in a case of bilateral occlusive cerebrovascular disease associated with intracranial aneurysm. *Acta Neurol Scand.* 1996;Suppl. 166: 104-109.
- Spallone A, Cantore G. The role of extracranial carotid abnormalities in the genesis of cerebral aneurysms. *J Neurosurg.* 1981;55:693-700.
- Wang YY, Rosenfeld JV, Lyon SM, O'Brien BJ. Rapid development of a de novo intracranial aneurysm following rapid occlusion. *J Clin Neurosci.* 2008; 15: 324-330.

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