Carotid Endarterectomy In Patients With Incidental Intracranial Aneurysms

Rastlantısal İntrakranialı Anevrizmalı Hastalarda Karotid Endarderektomi

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Abstract: The surgical management of patients with symptomatic carotid stenosis in combination with one or more incidental intracranial aneurysms is problematic. We discuss this issue with reference to two cases, and in light of the relevant literature. Our conclusion is that the best management plan is aneurysm clipping via craniotomy, followed by microvascular endarterectomy under barbiturate protection, all in the same surgical session.

Key Words: Carotid endarterectomy, incidental aneurysm, surgical strategy

Özet: Semptomatik karotis stenozlu ve rastlantısal olarak tespit edilen bir veya daha fazla intrakranial anevrizması olan hastaların cerrahi tedavisinin planlanması önemli bir problemdir.Bu konuyu makalemizde , 2 hastamızı sunarak ve ilgili literatür bilgileri ışığı altında tartıştık. Sonuçlarımıza ve tecrübelerimize göre, ilk olarak kraniotomi ile intrakranial anevrizmanın kliplenmesi, ardından barbitürat koruması altında mikrovasküler endarterektominin aynı seansta uygulanması, en iyi cerrahi tedavi planıdır.

Anahtar Kelimeler: Karotid endarterektomi, insidental anevrizma, cerrahi strateji

INTRODUCTION

The results of the Asymptomatic Carotid Atherosclerosis Study (ACAS) (1) showed that two trends have emerged for managing arteriosclerotic disease at the bifurcation of the carotid artery. One route taken by centers with less than 3% per- and postoperative mortality has been to expand the indications for carotid endarterectomy to include asymptomatic cases with 60% luminal stenosis. The other trend has been towards more widespread use of digital subtraction angiography (DSA) for evaluating disease at the carotid bifurcation, but this technique has associated morbidity and mortality. These risks have led some vascular surgeons to operate on carotid stenosis cases after only a duplex ultrasound (US) scan of the bifurcation, and without further evaluating the intracranial vasculature. It has been estimated that incidental intracranial aneurysms are found in 2.8-5% of patients who undergo cerebral angiography while being evaluated for extracranial vascular disease (3,24,31,32).

The patient with asymptomatic or symptomatic carotid stenosis who also has an incidental intracranial aneurysm presents a different set of challenges than the individual with subarachnoid

hemorrhage, since the already serious problem of carotid stenosis is compounded by the life-threatening risk of aneurysm rupture. In this article, we examine this issue in two cases and discuss the relevant literature.

CASE REPORTS

Case # 1:

A 60-year-old female patient reported having experienced a transient right-sided episode of hemiparesis 24 hours before admission. Her transient ischemic attack resolved spontaneously within 8 hours, but she also experienced severe headache for 10 hours. The results of the patient's physical and neurological examinations were within normal limits. Cranial computed tomography (CT) revealed an ischemic area in the right centrum semiovale. Duplex US scan of the carotid arteries showed 70% luminal stenosis at the bifurcation of the left internal carotid artery, as well as altered hemodynamics. DSA confirmed 70% stenosis of the left internal carotid artery, and revealed an aneurysm at the bifurcation of the right middle cerebral artery (MCA) (Figure 1A-B).

Figure 1A: Left cervical segment DSA of Case # 1.

We clipped the right MCA aneurysm through a right-sided pterional craniotomy, and then performed a left carotid endarterectomy during the same session. Care was taken not to induce hypotension during the craniotomy and clipping, and the patient was not heparinized during the endarterectomy. The patient had an uneventful recovery. Follow-up DSA confirmed that the right MCA aneurysm had been clipped successfully, and showed good cosmetic results of the left carotid artery endarterectomy (Figure 2A-B).

Case # 2:

A 58-year-old female patient was admitted after she reported having experienced several episodes of right-sided weakness over the previous 8 months. She said that all these episodes had resolved spontaneously within 2-4 days, and she exhibited no neurological deficits. The patient's physical and neurological examinations were normal, apart from mild systolic hypertension. Cranial CT revealed multiple periventricular microinfarcts bilaterally. Duplex sonography showed 95% stenosis at the bifurcation of the left internal carotid artery, with ulceration and altered hemodynamics at the site. DSA of the cervical and intracranial vasculature confirmed the ultrasonographic diagnosis and also revealed an aneurysmal dilatation in the left posterior communicating artery, a finding that was consistent in all angiographic positions (Figure 3A-B).

We performed a left pterional craniotomy and exposed a fusiform dilatation of the left posterior

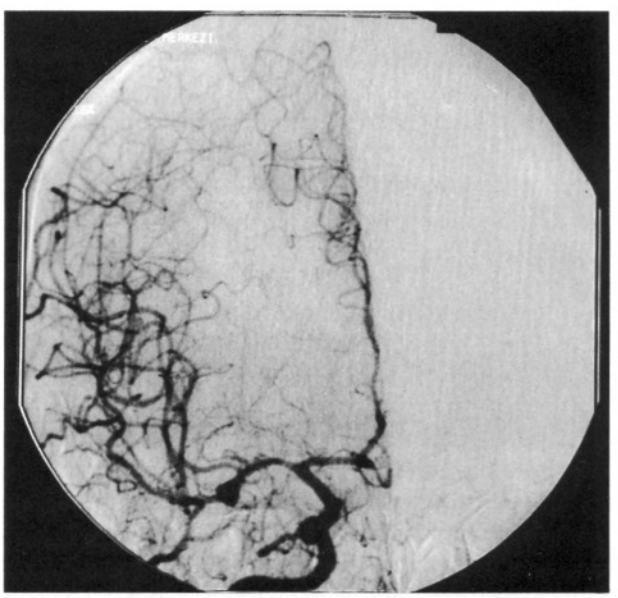

Figure 1B: Right intracranial segment DSA of Case # 1.

Figure 2A: Post-operative left cervical DSA of Case # 1.

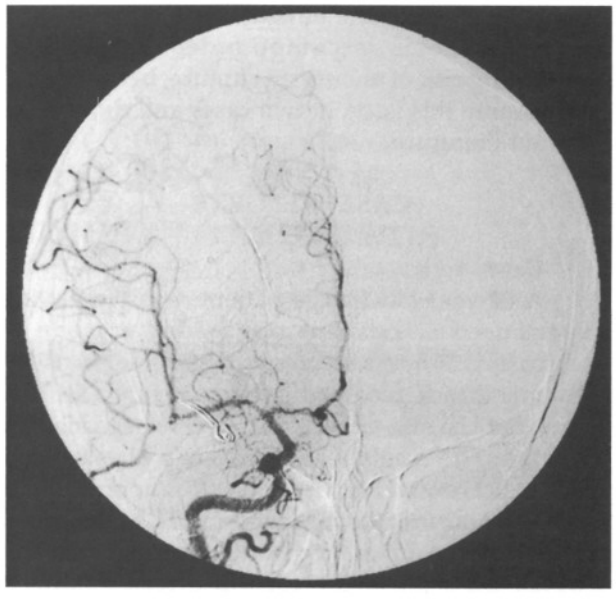

Figure 2B: Post-operative right intracranial segment DSA of Case # 1.

communicating artery. Since clipping was not possible due to the fusiform dilatation we wrapped the aneurysm with fascia in usual fashion. After the craniotomy, we did a left carotid microendarterectomy during the same session, under barbiturate protection and without heparinization. The patient's recovery was uneventful. Follow-up DSA showed good cosmetic results of the endarterectomy, and filling of the posterior communicating aneurysm (Figure 4A-B).

DISCUSSION

Completion of the ACAS (1), which followed the North American Symptomatic Carotid Endarterctomy Trial (NASCET) (28), expanded the indications for carotid endarterectomy surgery to include asymptomatic patients with 60% stenosis. The previous criterion for this type of treatment was 70% or more carotid stenosis in a symptomatic patient. Currently, vascular surgeons are doing more of these operations than ever before, with patient clinical pictures ranging from more than 70% stenosis in symptomatic cases to 60% stenosis in asymptomatic cases. This significant rise in numbers has led to the use of duplex US scan as the sole diagnostic test for making decisions about how to manage carotid stenosis. However, the use of this method alone has major limitations in that it tells nothing about how the condition of the carotid arteries is affecting the brain, the main organ of interest. Any vascular study that does not reveal the intracranial vasculature must be considered incomplete. A duplex US scan of the cervical segment of carotid arteries does not reveal intracranial aneurysms, arteriovenous malformations (AVMs) or distal stenosis of the intracranial circulation. Lacking this crucial information, a surgeon performing an endarterectomy at the bifurcation of a carotid artery can find him- or herself in tragic circumstances if an unidentified intracranial aneurysm ruptures, or if the patient's symptoms worsen due to having overlooked distal stenosis of the same artery.

DSA remains the gold standard of vascular studies, and is required in all patients with carotid stenosis to fully evaluate intracranial and extracranial circulation. The finding of incidental berry aneurysms in patients undergoing carotid endarterectomy raises the issues of which lesion should be treated first, and whether an incidental aneurysm should be treated at all (23,27). The risk of bleeding from an asymptomatic intracranial aneurysm during 5-year follow-up has been

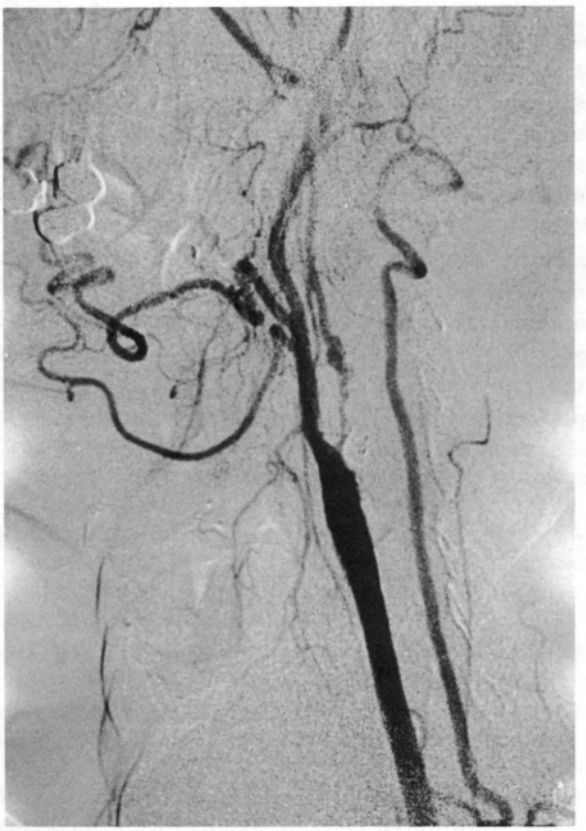

Figure 3A: Left cervical segment DSA of Case # 2.

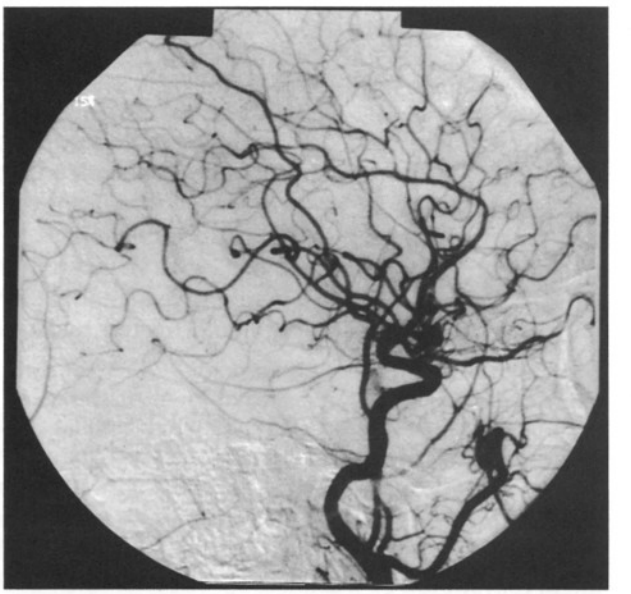

Figure 3B: Left intracranial segment DSA of Case # 2.

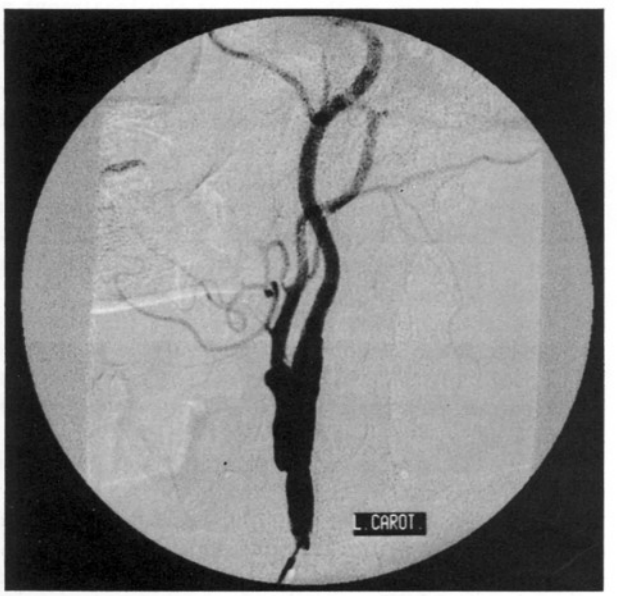

Figure 4A: Post-operative left cervical DSA of Case # 2.

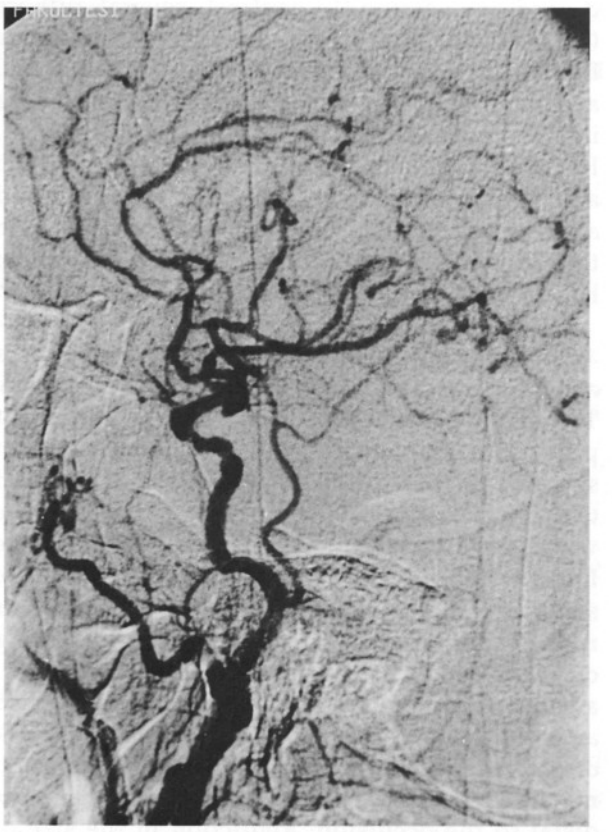

Figure 4B: Post-operative left intracranial segment DSA of Case # 2.

estimated at 10-17% (9,25). In view of the natural history of this lesion, an increasing number of neurosurgeons have recommended elective clipping of incidentally discovered intracranial aneurysms (12,26,30). More recent reports have suggested a more aggressive approach to this type of aneurysm

(15,16,17,18), with surgery indicated for patients less than 70 years of age who have a life expectancy of more than 5 years, and for coincidental aneurysms larger than 4-5 mm (5,19,20,21,22). Data in the literature suggest a 1-2% annual rate of bleeding (15,17), and a mortality rate of 50% per bleeding episode (15,16) in aneurysmal subarachnoid hemorrhage. Since incidental aneurysms can be treated with 1% mortality and 4% overall morbidity (10,20,21), these can be efficiently managed together with carotid stenosis in patients affected by both problems.

There is controversy over which lesion should be treated first, the best sequence for carotid surgery and craniotomy, and whether these procedures should be done in separate operations or together in one session. Our opinion is that an intracranial aneurysm should be treated first, followed by carotid endarterectomy performed under barbiturate protection, and that both procedures should be done during one session. In contrast, several authors (2,7,11) have opted to deal with the stenosis issue first, regardless of the size or site of the aneurysm, and have reported no aneurysmal bleeding in the intraoperative or immediate postoperative period. However, one patient reported by Adams (2) and two aneurysm patients in the NASCET (28) did bleed after endarterectomy. Of these three, one patient in the NASCET report and Adams' patient died due to hemorrhage.

Correction of severe stenosis generally causes a marked increase in blood flow distal to the lesion. The classical work of Ferguson (11,12) showed that pressure in the aneurysmal sac is equal to mean systemic pressure, and that both the turbulence and the tension at the aneurysmal circumference rise when the arterial blood pressure increases (the Laplace law). It follows that correction of severe stenosis increases the chance of enlarging or rupturing an aneurysm. In other words, repairing carotid stenosis before addressing an intracranial aneurysm may expose the aneurysm to increased arterial pressure, and, theoretically, increase the risk of rupture (14). Conversely, partial carotid occlusion may impart a protective effect upon an aneurysm distal to the occlusion. Reduction in the size of intracranial aneurysms has been documented following intentional partial carotid occlusion (4,6).

Our experience is too limited to make definite conclusions. Analysis performed by Dippel et al. (8) suggested that a good technical job in a single case is not a solid enough decision-making basis when considering the issues of quality of life, or the gamble of living with the knowledge that one has an aneurysm that could rupture at any time with devastating results. We share the opinion expressed by Pappada et al. (29), that intracranial aneurysms should be treated first; however, in contrast to their method, we perform microendarterctomy during the same surgical session. We suggest that carotid stenosis patients with incidental aneurysms who meet the required surgical criteria should have their aneurysms addressed first. The carotid stenosis should be treated second, during the same session, via microendarterectomy under barbiturate protection.

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