Is It Possible That This Patient is Asymptomatic? The Role of Multidetector CT Angiography in Detection of Ulcerated Plaques in Patients with Asymptomatic Carotid Stenosis: Case Report

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SUMMARY

Introduction Although intervention in patients with symptomatic carotid disease is generally accepted as beneficial, the management of asymptomatic disease is still controversial. We wanted to introduce and discuss treatment options in a patient with asymptomatic carotid stenosis and high embolic potential lesions of common and internal carotid artery detected by multidetector computed tomography (MDCT).

Case Outline A 78-year-old female patient was admitted to our institution for diagnostics and surgical treatment of asymptomatic high-grade carotid stenosis. Upon admission, color duplex ultrasonography of the carotid arteries revealed the left common carotid artery (CCA) stenosis of 50% and the ipsilateral internal carotid artery (ICA) stenosis of 60%, while the right CCA was narrowed by 60% and the ipsilateral ICA by 80%. Because of the left subclavian artery (LSA) occlusion, also described by ultrasonography, MDCT angiography was performed to assess arterial morphology for possible angioplasty. In addition to LSA occlusion, MDCT angiography surprisingly revealed significant left CCA (>80%) and ICA (>70%) narrowing by ulcerated plaques with high embolic potential. Surgical treatment of the left CCA and ICA was indicated and Dacron® tubular graft interposition was performed. The postoperative course was uneventful and the patient was discharged from the Institute on the third postoperative day. After the six-month follow-up the patient was doing well with well-preserved graft patency.

Conclusion Although color duplex ultrasonography is reliable and safe imaging modality in carotid stenosis diagnosis, MDCT angiography plays a significant role in patients with asymptomatic carotid stenosis since plaques with high embolic potential could be detected, which, if left untreated, could have severe neurological ischemic consequences.

Keywords: asymptomatic carotid disease; internal carotid artery; carotid endarterectomy

INTRODUCTION

Although intervention in patients with symptomatic carotid disease is generally accepted as beneficial, the management of asymptomatic disease is still controversial [1-5]. We wanted to introduce and discuss treatment options in an asymptomatic patient with severe embolic lesions of common and internal carotid artery detected by multidetector computed tomography angiography (MDCT).

CASE REPORT

A 78-year-old female patient was admitted to the Vascular Surgery Clinic for color duplex ultrasonography of supra-aortic branches. Upon admission she denied any cerebral ischemia symptoms, brain CT had not been done previously. Color duplex ultrasonography of the carotid arteries revealed left common carotid artery (CCA) stenosis of 50% and ipsilateral internal carotid artery (ICA) stenosis of 60% while the right CCA was narrowed by 60% and the ipsilateral ICA by 80%. The plaque morphology was defined as fibrocalcified. The left subclavian artery (LSA) was occluded with complete steal phenomenon. For the previous ten years she had been treated for diabetes and two years prior to admission an amputation of the thumb of the left leg was done for irreversible ischemic lesions. She also complained of intermittent claudication after 100 meters, with ankle brachial index of 0.55 on both legs.

Prior to LSA percutaneous angioplasty (PTA) MDCT angiography of supra-aortic branches was performed to assess their anatomy, which surprisingly revealed the left CCA stenosis >80% and ICA >70% narrowing by ulcerated plaque with extremely high embolic potential (Figures 1a and 1b).

After detailed analysis of the plaque morphology, volume and composition, a radiologist of our institute clearly confirmed that these plaques had high embolic potential. Ulceration of the plaque was defined as extension of contrast media beyond the vascular lumen into the surrounding plaque. For classification based on the density, we used Schroeder's classification [6]: fatty (soft) plaques – density values <50 Hounsfield Unit (HU); mixed plaques – den-

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Figure 1. Multidetector CT angiography of left common carotid artery (CCA) and internal carotid artery (ICA): A) Three-dimensional view (on the left); B) Three-dimensional – maximum/minimum intensity projection (MIP) volume rendering view (on the right)

sity value between 50 and 119 HU; and calcified plaques > 120 HU. According to this classification, plaques presented in this patient were partly mixed and partly calcified.

The right CCA was narrowed by 60% and the ipsilateral ICA by 80%. Lower extremity MDCT angiography was done as well, which showed bilateral superficial femoral artery (SFA) high-grade stenosis (>90%) and significant narrowing of the below-the-knee arteries.

On the basis of these findings we indicated first the reconstruction of the left CCA and ICA, then the right carotid endarterectomy, followed by LSA PTA and afterward PTA of the SFA and below-the-knee arteries on both sides.

Prior to carotid surgery, brain CT was done, which showed bilateral frontal multiple lacunar infarcts accompanied with leukoencephalopathy. Intraoperatively, diffuse atherosclerotic lesions were verified on the left CCA in the form of ulcerated plaques with high embolic potential (Figure 2) and Dacron® tubular graft interposition was performed (Figure 3). The postoperative course was uneventful and the patient was discharged from the Institute on the third postoperative day. After one-month and six-month follow-ups ultrasonography showed well preserved graft patency with excellent neurological clinical presentation.

DISCUSSION

The Asymptomatic Carotid Atherosclerosis Study (ACAS) and Asymptomatic Carotid Surgery Trial (ACST) examined the role of carotid endarterectomy in asymptomatic patients and ICA stenosis range in the range of 60–99% [2, 3]. ACAS study showed that over five years the risk of stroke or stroke and death was 11% in patients who were medically treated versus 5.1% in patients who underwent endarterectomy [2].

Similarly, ACST results showed that five-year risk in asymptomatic patients with severe ICA stenosis was 6.4% for all strokes or death in patients having carotid endarterectomy, versus 11.8% with no surgery [3]. In ACAS most of the patients underwent angiography prior to surgery while in the ACST study only a few patients underwent

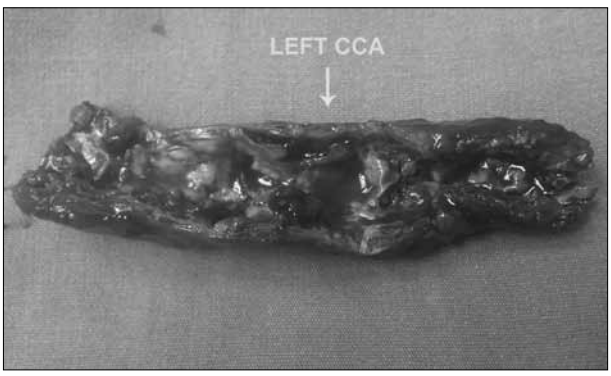

Figure 2. Intraoperative findings of the left common carotid artery (CCA)

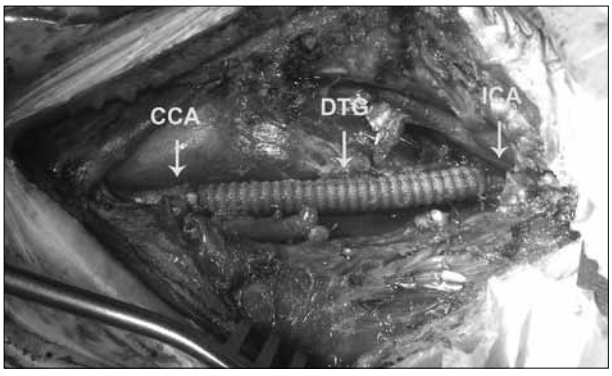

Figure 3. Dacron® tubular graft (DTG) interposition between the left common carotid artery (CCA) and internal carotid artery (ICA)

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angiography and the accuracy of color duplex ultrasonography only could be questioned [2, 3].

By now it is well established that carotid plaque morphology could be an independent risk factor for stroke in asymptomatic patients [7]. Several studies showed that the presence of echolucent carotid plaque is related to elevated stroke risk [8, 9]. Although color duplex ultrasonography has proven to be a reliable diagnostic procedure for carotid atherosclerosis, Saba et al. [10] showed that MDCT angiography detects the carotid plaque ulceration with higher sensitivity and specificity compared with color duplex ultrasonography, and concluded that this imaging modality is recommended as a useful step for correct presurgical planning. When ulceration detection by MDCT was compared with intraoperative findings, surgical confirmation had overall sensitivity of 93.9% and a specificity of 98.7%; out of 32 ulcers detected by the MDCT, 31 were confirmed by surgery [10]. For plaque assessment based on density, the authors used the same classification by Schroeder et al. [6] that we've used in the presented case.

More recently, Saba et al. [11] have analyzed the relationship between MDCT angiography-assessed carotid plaque volume and composition and the presence of ulceration. The authors concluded that there is no correlation between total carotid atherosclerotic plaque volume and ulcerations, and that plaque relative lipid volume (<60 HU) is associated with the presence of ulceration. The authors stated that this finding could indicate vulnerable plaques causing increased risk for cerebrovascular events.

In a recently published paper, Homburg et al. [12] have analyzed the association of atherosclerotic carotid plaque ulceration detected by MDCT with non-lacunar ischemic stroke. They found that atherosclerotic carotid plaque ulceration is associated with non-lacunar ischemic stroke, independent of the degree of carotid stenosis and that carotid ulcerations could be successfully detected by the means of MDCT. In a more recent paper the same author evaluated the association between carotid artery plaque ulceration and plaque characteristics in ischemic stroke patients with ≥50% stenosis and patients with lower degree of stenosis (0–49%) [13]. The authors found that plaque volume, degree of stenosis and large lipid-rich necrotic core proportion evaluated with MDCT are associated with carotid artery plaque ulceration, even in patients with a low degree stenosis (0– 49%). The most important conclusion is that plaque volume and composition analysis with MDCTA may identify rupture prone plaques and improve risk stratification in patients with ischemic stroke [13].

Our institute is a high-volume center for eversion carotid endarterectomy with over 900 procedures per year [14-17]. In a recently published study we've analyzed 9,897 CEAs done for the past 20 years at our institution and for the final diagnosis we've used duplex scanning in 83.4% of patients and angiography in only 16.3% [17]. Presently, at our institute conventional angiography is replaced by MDCT angiography, which is performed in cases when color duplex ultrasonography is not reliable enough – near-total ICA occlusions, kinks, coils, long plaque propagation or restenosis. However, as seen in the case presented, MDCT angiography could be very helpful in the evaluation of asymptomatic patients precisely defining quality and the degree of carotid stenosis. Bearing in mind severe ulcerated plaques in the presented case, if left untreated this patient probably would have been at high risk of stroke in the next several years, which highlights MDCT angiography as a very important imaging modality in asymptomatic patients.

Although color duplex ultrasonography is a reliable and safe imaging modality in carotid stenosis diagnosis, MDCT angiography plays a significant role in patients with asymptomatic carotid stenosis since plaques with high embolic potential could be detected, which, if left untreated, could have harmful consequences. Future studies are needed to determine the role of MDCT angiography in evaluation of patients with asymptomatic carotid stenosis.

NOTE

Ethics Committee of our institution approved this manuscript.

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Да ли је могуће да је овај болесник без симптома? Улога мултидетектор *CT* ангиографије у откривању улцерисаних плакова код болесника са асимптоматском каротидном стенозом – приказ болесника

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КРАТАК САДРЖАЈ

Увод Док су интервенције код симптоматских болесника с каротидном стенозом генерално прихваћене и оцењене као корисне, лечење болесника код којих се не јављају симптоми овог обољења и даље је предмет расправа. Желимо да прикажемо и продискутујемо случај болеснице са асимптоматском каротидном стенозом код које су мултидетектор компјутеризованом ангиографијом (*MDCT*) откривена значајна сужења заједничке и унутрашње каротидне артерије улцерисаним плаковима високог емболигеног потенцијала.

Приказ случаја Жена стара 78 година примљена је на наш институт због дијагностике и хируршког лечења асимптоматске каротидне стенозе високог степена. По пријему, ултразвучни преглед каротидних артерија открио је сужење леве заједничке каротидне артерије (ЗКА) од 50%, ипсилатералне унутрашње каротидне артерије (УКА) од 60%, десне ЗКА од 60% и ипсилатералне УКА од 80%. Због оклузије леве поткључне артерије (ЛПА), болесница је подвргнута *MDCT* артериографији ради процене могућности перкутане ангиопластике ЛПА. Осим оклузије ЛПА, налаз *MDCT* артериографије је изненађујуће показао и значајно сужење леве ЗКА (>80%) и леве УКА (>70%) улцерисаним плаковима високог емболигеног потенцијала. Индиковано је хируршко лечење, те је интерпониран дакронски тубуларни графт између леве ЗКА и УКА. Постоперациони ток је протекао нормално и болесница је пуштена кући трећег дана од операције. После шест месеци болесница се осећала добро, а графт је био проходан.

Закључак Премда је ултрасонографија веома поуздана и сигурна у дијагностиковању каротидне стенозе, *MDCT* ангиографија игра важну улогу у дијагностици болесника са асимптоматском каротидном стенозом будући да се могу открити значајна сужења улцерисаним плаковима високог емболигеног потенцијала, која би, уколико се не би лечила, могла довести до тешких неуролошких исхемијских последица.

Кључне речи: асимптоматска каротидна болест; унутрашња каротидна артерија; каротидна ендартеректомија

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