Acta Clin Croat 2009; 48:241-246 Original Scientific Paper

THE CONTRALATERAL CAROTID DISEASE IN PATIENTS WITH INTERNAL CAROTID ARTERY OCCLUSION

Arijana Lovrenčić-Huzjan, Maja Strineka, Dražen Ažman, Sanja Štrbe, Darja Šodec-Šimičević and Vida Demarin

University Department of Neurology, Reference Center for Neurovascular Disorders and Reference Center for Headache of the Ministry of Health and Social Welfare of the Republic of Croatia, Sestre milosrdnice University Hospital, Zagreb, Croatia

SUMMARY – The one-year incidence of carotid occlusion is 6/100 000 inhabitants in general population. Stroke incidence and mortality rate in these patients vary. Patients that underwent carotid endarterectomy (CES) are at a higher risk of progression of contralateral carotid stenosis. The aim of the study was to investigate the management and natural history of the contralateral internal carotid artery disease in patients with internal carotid artery occlusion (ICAO). During one year, 297 patients with ICAO were investigated. Follow up examinations were retrospectively analyzed and patients were divided into groups according to contralateral carotid disease. Out of 297 patients, only one investigation was performed in 90 patients with carotid occlusion. Thirty three patients were followed up due to postoperative ICAO. In 14 patients, ICAO developed during ultrasonographic follow up. In this group of patients, 9 had unchanged contralateral findings, whereas in 5 patients disease progression was observed. Out of 44 patients with ICAO and contralateral subtotal stenosis at initial investigation, 42 underwent carotid surgery. Postoperatively, 32 patients had normal findings, 6 developed mild carotid stenosis, 2 developed moderate carotid stenosis, and 2 had postoperative carotid occlusion. Two patients were followed-up without intervention. Nine patients with bilateral ICAO were followed-up for years. Follow up was continued in 106 patients with ICAO and contralateral mild to moderate changes. The finding was unchanged in 68 patients. In 21 (30%) patients the disease progressed to subtotal stenosis and 18 patients underwent carotid surgery. Accordingly, contralateral carotid disease progression was observed in one third of patients with carotid occlusion. Additional studies on the issue are needed.

Key words: *Carotid stenosis – complications; Cerebral infarction – epidemiology; Carotid occlusion; Endarterectomy, carotid*

Introduction

Stroke is the second most common cause of death worldwide. It is also a major cause of disability[1]. Carotid artery stenosis is defined as narrowing of the arterial lumen; it is considered symptomatic if ipsilateral retinal or cerebral ischemia has occurred. It is an important cause of stroke and other adverse neurologic events. Transient ischemic attack (TIA) or ischemic stroke is associated with occlusion of one of the carotid arteries in 9% of patients[2]. Association of TIA or stroke with bilateral carotid artery occlusion is reported in 0.4% of cases[3]. These patients do not appear to be at a higher risk of recurrent ischemic stroke[3].

The reported rate of asymptomatic carotid stenosis is between 2% and 18%, depending on the population

Correspondence to: *Arijana Lovrenčić-Huzjan, MD, PhD*, University Department of Neurology, Sestre milosrdnice University Hospital, Vinogradska c. 29, HR-10000 Zagreb, Croatia

E-mail: arijana.lovrencic-huzjan@zg.t-com.hr

studied[4]. In a large population-based study of nearly 7,000 individuals, the prevalence of 3.8% in men and 2.7% in women was found[5]. In the general population, the annual incidence rate of symptomatic internal carotid artery occlusion (ICAO) is about 6/100,000[6].

Age, hypertension, cigarette smoking, hyperlipidemia, diabetes mellitus, male sex and fibrinogen as well established risk factors for atherosclerosis correlate with carotid stenosis and its severity[5-8].

Neurosonologic follow up of carotid artery is recommended after carotid endarterectomy (CEA). The incidence of postoperative stenosis of ICA (above 60% diameter reduction) is between 13% and 21%[9]. In most hospitals, patients would undergo second CEA in case of significant restenosis.

Monitoring of the progression of contralateral carotid artery stenosis is even more important for follow up examination because contralateral progression has been found to be more common than ipsilateral recurrent stenosis. In only one study, 82 patients with carotid occlusion and contralateral ICA stenosis greater than 60% were followed[10]. If the stenosis progressed to more than 70%, CEA was performed. In this study, a higher incidence of ipsilateral strokes and all strokes was observed in these patients.

The aim of this retrospective study was to show the development of ICA occlusion and the natural history of the contralateral carotid disease.

Patients and Methods

During one-year period, 8,000 patients were examined at Cerebrovascular Laboratory. Patient follow up examinations were retrospectively analyzed and patients with ICA occlusion were classified into groups. Carotid color duplex finding (CCDFI) of both carotid arteries were assessed for plaque morphology and grade of stenosis. CCDFI was performed by use of color-doppler ultrasound on ALOKA 5500 and α10 Premium with a 10-MHz linear probe.

Table 1. Demographic data of patients with occlusion found on initial examination

No. of patients	90
Sex	56 male/34 female
Median age (yrs)	71
Side of internal carotid artery occlusion	41 right/51 left
Side of common carotid artery occlusion	7 right/5 left

Table 1a. Finding on contralateral carotid artery in patients with occlusion found on initial examination

Grade of stenosis	n	
0%-50%	62	68.9%
51%-75%	8	8.9%
≥75%	11	12.2%
Occlusion	9	10%

The grade of stenosis was analyzed according to the defined criteria[11]. Stenosis is considered mild if the reduction of diameter is below 50%, moderate stenosis means 51%-75% reduction, and significant stenosis means reduction over 75% of diameter. Carotid artery occlusion was diagnosed if color coded flow and hemodynamic spectrum were absent.

Group 1 consisted of patients with only one CCDFI finding, group 2 of patients with postoperative ICA occlusion, and all others were divided into

Table 2. Demographic data of patients with occlusion developed during follow up

No. of patients	14
Sex	11 male/3 female
Median age (yrs)	69.2
Median time of follow up (yrs)	3.7
Side of internal carotid artery occlusion	7 right/7 left

Table 2a. Finding on contralateral carotid artery in patients with occlusion developed during follow up

Unchanged finding		9 (64.3%)
Progression	Mild stenosis – occlusion	2
	Mild to significant stenosis	1
	Moderate stenosis – occlusion	1
	Significant stenosis – occlusion	1
	Total	5 (35.7%)

Table 3. Demographic data of patients with carotid artery occlusion and contralateral significant carotid stenosis

No. of patients	44
Sex	40 male/4 female
Median age (yrs)	70.2
Median time of follow up (yrs)	4.7
No. of patients with carotid endarterectomy performed	42 (95.5%)

several groups according to the mode of occlusion development or finding on the contralateral carotid artery. Data are presented as numbers and percentage for each group.

Results

There were 297 patients with carotid occlusion recorded. Data on group 1 patients examined only once during the current year are presented in Table 1. The finding on contralateral carotid artery is presented in Table 1a. Group 2 consisted of patients with postoperative occlusion. There were 33 such patients, but the results are published separately. The rest of patients were divided into another four groups. Data on patients that developed occlusion during follow up (group 3) are presented in Table 2, and contralateral ICA findings in Table 2a. Occlusion of carotid artery developed after a median follow up of 3.7 years and progression of contralateral carotid disease was detected in 35.7% of patients. Group 4 consisted of 44 patients with occlusion of one carotid artery and subtotal stenosis of the other. Out of these 44 patients, 42 (95.5%) underwent CEA. Two patients were followed-up without intervention. Postoperative restenosis was found in 23.7% of the patients operated on. Data on these patients are presented in Tables 3 and 3a. Group 5 had nine patients with bilateral carotid artery occlusion, were followed-up for 4.9 years (Table 4). In group 6 there were patients with previously found occlusion of one carotid artery, followed for a median time of 4.8 years. Data on these patients are shown in Table 5. Progression of contralateral carotid disease was found in 35.9% of patients (Table 5a).

Table 3a. Postoperative finding in patients with carotid artery occlusion and carotid endarterectomy performed on contralateral side

No. of patients with carotid endarterectomy performed		42 (95.5%)
Satisfactory postoperative finding		32 (76.2%)
Postoperative progression	Mild stenosis	6
	Moderate stenosis	2
	Significant stenosis	2
Total		10 (23.7%)

Discussion

Our results showed contralateral carotid artery stenosis to have progressed in one third of patients with carotid occlusion. Atherosclerosis is a system disease that affects all vascular beds. In a survey by Paraskevas and Mikhailidis, advanced carotid stenosis contralaterally to symptomatic ICAO was found in 42.5% of

Table 4. Demographic data of patients followed-up for bilateral carotid artery occlusion

No. of patients	9
Sex	8 male/1 female
Median age (yrs)	68.3
Median time of follow up (yrs)	4.9
Side of internal carotid artery occlusion	9 both right and left
Side of common carotid artery occlusion	1 both right and left

Table 5. Demographic data of patients with previously diagnosed carotid artery occlusion

No. of patients	106
Sex	72 male/34 female
Median age (yrs)	68.9
Median time of follow up (yrs)	4.8
Side of internal carotid artery occlusion	52 right/54 left
Side of common carotid artery occlusion	2 right/4 left

patients[7]. A higher risk of cerebrovascular events has also been reported, since 43.3% of the plaques were echolucent and therefore more likely to progress[7]. In another survey of patients with ICAO that who presented with stroke in 57% and TIA in 8% of cases, moderate to severe stenosis of the contralateral carotid artery was found in 47% of patients, and one third of these patients ultimately required carotid surgery[8]. In our patients, moderate stenosis to occlusion (51%-100% diameter reduction) of the contralateral carotid artery was detected in one third (31.1%) of patients with only one CCDFI examination performed (group 1). In the group of patients that developed ICA occlusion during follow up (group 3), progression of the contralateral carotid stenosis was also found in around one third of patients (35.7%). Group 4 consisted of patients with occlusion of one ICA and subtotal stenosis of the other carotid artery. After CEA had been performed, restenosis of ICA was found in nearly one third (23.7%) of these patients. In group 6 consisting of patients with ICA occlusion and monitored for nearly 5 years, contralateral progression was recorded in 35.9% of patients. Therefore, atherosclerotic disease is progressive and is affecting both sides.

In all groups, there was a significant male predominance (group 1: 62%; group 3: 78.6%; group 4: 90.9%; group 5: 88.9%; and group 6: 68%), as shown in previous studies[12,13]. A study of 82 patients with asymptomatic carotid stenosis (60%-69%) and contralateral carotid occlusion showed 20 (24%) patients to have progressed to significant stenosis of over 70%, and 11 patients had associated symptoms. These patients had a higher incidence of late stroke and TIA (33% and 27%, respectively), even if on optimal medical therapy[9].

Table 5a. Finding on contralateral carotid artery in patients with previously diagnosed carotid artery occlusion

Unchanged finding		68 (64.1%)
Progression	Mild stenosis	9 (23.3%)
	Moderate stenosis	8 (21%)
	Significant stenosis	3 (7.9%)
	Patients that underwent carotid surgery	18 (47.4%)
	Total	38 (35.9%)

Patients with ICAO should undergo control ultrasonography more frequently than those without ICAO[9]. Current guidelines recommend screening of subpopulation aged over 65 or with at least 3 of the following risk factors: hypertension, hyperlipidemia, cigarette smoking and coronary heart disease[4,14-16].

In conclusion, patients with carotid artery occlusion are at a greater risk of developing a higher degree of contralateral carotid artery stenosis. These patients should be carefully investigated and followed-up; attention should be paid to the management of their vascular risk factors in order to reduce the risk of adverse cerebrovascular events.

References

1. DEMARIN V. Stroke – an update at the turn of the millennium. Laboratory diagnosis of neurologic diseases, part one. Biochemia Medica 2001;81:87-91.
2. MEAD GE, WARDLAW JM, LEWIS SC, DENNIS MS. No evidence that severity of stroke in internal carotid occlusion is related to collateral arteries. J Neurol Neurosurg Psychiatry 2006;77:729-33.
3. PERSOON S, KLIJN C, ALGRA A, KAPPELLE JAAP L. Bilateral carotid artery occlusion with transient or moderately disabling ischaemic stroke: clinical features and long-term outcome. J Neurol 2009;256:1728-35.
4. QURESHI AI, ALEXANDROV AV, TEGELER CH, HOBSON RW 2nd, DENNIS BAKER J, HOPKINS LN; American Society of Neuroimaging; Society of Vascular and Interventional Neurology. Guidelines for screening of extracranial carotid artery disease. J Neuroimaging 2007;17:19-47.
5. MATHIASEN EB, JOAKIMSEN O, BONAA KH. Prevalence of and risk factors associated with carotid artery stenosis: the Tromso Study. Cerebrovasc Dis 2001;12:44-51.
6. FLAHERTY ML, FLEMMING KD, McCLELLAND R, JORGENSEN NW, BROWN RD. Population-based study of symptomatic internal carotid artery occlusion. Stroke 2004;35:1785-2011.
7. PARASKEVAS KI, MIKHAILIDIS DP. Internal carotid artery occlusion: association with atherosclerotic disease in other arterial beds and vascular risk factors. Angiology 2007;58:329-35.
8. ALEXANDER JJ, MOAWAD J, SUPER D. Outcome analysis of carotid artery occlusion. Vasc Endovasc Surg 2007;41:409-16.
9. MOORE WS, KEMPCZINSKI RF, NELSON JJ, TOOLE JF. Recurrent carotid stenosis: results of the ACAS. Stroke 1998;29:2018-25.
10. AbuRAHMA AF, METZ MJ, ROBINSON PA. Natural history of > or =60% asymptomatic carotid stenosis in patients with contralateral carotid occlusion. Ann Surg 2003;238:551-61.
11. LOVRENČIĆ-HUZJAN A, BOSNAR-PURETIĆ M, VUKOVIĆ V, MALIĆ M, THALLER N, DEMARIN V. Correlation of carotid color Doppler and angiographic findings in patients with symptomatic carotid artery stenosis. Acta Clin Croat 2000;39:215-20.
12. LOVRENČIĆ-HUZJAN A, BOSNAR M, HUZJAN R, DEMARIN V. Frequency of different risk factors for ischemic stroke. A one year survey on patients admitted to Neurology Department, Sestre milosrdnice University Hospital. Acta Clin Croat 1999;38:159-63.
13. VUKOVIĆ V, GALINOVIĆ I, LOVRENČIĆ-HUZJAN A, BUDIŠIĆ M, DEMARIN V. Women and stroke: how much do women and men differ? A review – diagnostics, clinical differences, therapy and outcome. Coll Antropol 2009;33:977-84.
14. DEMARIN V, LOVRENČIĆ-HUZJAN A, TRKANJEC Z, VUKOVIĆ V, VARGEK-SOLTER V, ŠERIĆ V, *et al.* Recommendations for stroke management – 2006 update. Acta Clin Croat 2006;45:219-85.
15. VUKOVIĆ V, MOLINA CA, RIBO M, LOVRENČIĆ-HUZJAN A, BUDIŠIĆ M, DEMARIN V. Neuroimaging techniques – improving diagnostic and therapeutic options in acute stroke. Acta Clin Croat 2006;45:331-41.
16. LOVRENČIĆ-HUZJAN A, VUKOVIĆ V, DEMARIN V. Neurosonology in stroke. Acta Clin Croat 2006;45:385-401.

Sažetak

BOLEST KONTRALATERALNE KAROTIDE U BOLESNIKA S OKLUZIJOM UNUTARNJE KAROTIDNE ARTERIJE

A. Lovrenčić-Huzjan, M. Strineka, D. Ažman, S. Štrbe, D. Šodec-Šimićević i *V. Demarin*

Godišnja incidencija okluzije unutarnje karotidne arterije (ACI) u općoj populaciji je 6/100.000 stanovnika. Godišnja razina moždanih udara i smrti vezanih uz okluziju ACI varira. U bolesnika u kojih je učinjena karotidna endarterektomija postoji povećani rizik progresije kontralateralne karotidne stenoze. Cilj ove studije bio je prikazati stanje kontralateralne karotidne bolesti u bolesnika s karotidnom okluzijom. U jednogodišnjem razdoblju u Cerebrovaskularnom laboratoriju Klinike za neurologiju pregledano je 8.000 bolesnika obojenim doplerom karotidnih arterija prema protokolu. Zabilježeno je 297 bolesnika s okluzijom ACI. Retrospektivno su analizirani nalazi doplera te su bolesnici prema nalazu na kontralateralnoj karotidnoj arteriji svrstani u 6 skupina. Okluzija ACI otkrivena je na prvom pregledu u 90 od 297 bolesnika. Poslijeoperacijski se okluzija razvila u 33 bolesnika. U 14 bolesnika okluzija je nastala tijekom praćenja. Kontralateralno je 9 bolesnika iz ove skupine imalo nepromijenjen nalaz, dok je u 5 zabilježena progresija bolesti. Operirana su 42 od 44 bolesnika s okluzijom ACI i subtotalnom stenozom kontralateralno na prvom pregledu. Poslijeoperacijski je 32 bolesnika imalo uredan nalaz, 6 je razvilo početnu stenozu, 2 umjerenu stenozu, a 2 poslijeoperacijsku okluziju ACI. Dvoje bolesnika je dalje praćeno bez intervencije. Devetoro bolesnika s obostranom okluzijom ACI praćeno je 4,9 godina. Praćenje je nastavljeno i u 106 bolesnika s okluzijom ACI te kontralateralno početnim do umjerenim promjenama. Nalaz je bio nepromijenjen u 68 bolesnika. U 21 (30%) bolesnika stenoza je napredovala do subtotalne, a 18 bolesnika je operirano. Dakle, progresija kontralateralne karotidne bolesti nastupila je u trećine bolesnika s okluzijom ACI.

Ključne riječi: *Karotidna stenoza – komplikacije; Moždani infarkt – epidemiologija; Karotidna okluzija; Endarterektomija, karotida*