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**LIMITED CAROTID SCREENING: IS IT INDICATED TO DETECT**  
**CAROTID DISEASE IN PRESENCE OF SYMPTOMATIC LIMB**  
**ISCHEMIA ?**

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**Summary:** A complete and thorough initial angiologic examination in patients with symptomatic arterial occlusive disease should include discovery of a previously undetected carotid bruit.

The aim of our study was to establish characteristics of asymptomatic carotid bruit based on physical examination and color-flow duplex scanning. We screened asymptomatic carotid artery disease in 109 patients with symptomatic peripheral vascular disease treated at University Surgical Clinic in Nis, and Institute for Cardiovascular Disease "Dedinje" in Belgrade.

Of 109 patients with no symptoms or signs of carotid occlusive disease, carotid bruit was present in 57 (52%); 17 were unilateral, (10 right and 6 left) and 40 were bilateral. The majority of the patients 27 (47%) were present with moderate to rough bilateral bruit.

All patients were studied with color-Doppler duplex scanning according to criterion of ACAS. Bilateral haemodynamically significant carotid artery stenosis (CAS)  $\geq 60\%$  was present in 18 (32%) patients, unilateral in 17 (30%) and in 22 patients (38%) asymptomatic carotid bruit was not originated from CAS  $\geq 60\%$ .

By univariate analysis significant CAS was associated with carotid bruit (results were considered significant if  $p < 0,05$ ). Probability that CAS  $\geq 60\%$  influenced the prevalence of asymptomatic carotid bruit, assessed by multivariate stepwise logistic regression analysis, was confirmed ( $t=0,50$ ;  $p=0,01$ ). The sensitivity of a carotid bruit in predicting CAS  $\geq 60\%$  was 67%, with a specificity of 56%. Degree of internal carotid stenosis was unrelated to plaque morphology.

Limiting screening of haemodynamically significant carotid artery stenosis to subgroups of patients with asymptomatic carotid bruit is ineffective, because more than one third of patients with CAS would be excluded in that way.

**Keywords:** a asymptomatic carotid artery stenosis, carotid bruit, peripheral vascular disease, screening.

## INTRODUCTION

Asymptomatic carotid stenosis is defined as presence of internal carotid/carotid bifurcation stenotic or occlusive lesions in patients with no signs or symptoms of cerebrovascular disease [9]. Lesions are important causative factor in unheralded stroke. Two factors are particularly important: severity of diameter stenosis (in percentage) and morphologic characteristics of stenotic plaque [1].

Natural history of asymptomatic carotid stenosis was for a long period unknown. Now is accepted that asymptomatic carotid stenosis: 1. Will not progress to symptomatic lesions nor change to any manner, 2. Will be presented as TIA, 3. Will be presented as completed stroke, 4. Will progress to total occlusion, but stay asymptomatic, or 5. Total occlusion will be presented as TIA or frank stroke [15,17]. The course of natural history is determined by characteristics of vessels and lesions (stenosis or occlusion, homogen or heterogen plaques, smooth, irregular or ulcerated plaque surface) and collateral pathways [17]. Asymptomatic

carotid stenosis will progress to symptomatic within the mean time 3 to 4 years. The frequency of completed stroke in asymptomatic patients with haemodynamically significant carotid stenosis, as in the patients with total occlusion: 2-5% [10,13].

Two large multicentric prospective studies dealt with benefits of surgical treatment of asymptomatic carotid stenosis by carotid endarterectomy related to best medical treatment: Department of Veterans Affairs Hospital Carotid Trial (completed in 1991) and ACAS – Asymptomatic Carotid Atherosclerosis Study (1995) [5,10]. ACAS study showed that surgical treatment of asymptomatic carotid stenosis  $\geq 60\%$  compared with best medical treatment, reduces relative risk of completed stroke 53%, and absolute 5-year risk from 11 % to 5,1 % (under the condition that carotid endarterectomy is performed with perioperative mortality and morbidity less than 3 %, and that it is supplemented with risk factors aggressive treatment which can be managed) [5]. At this moment there is being carried out prospective, randomized study ACST – Asympto-

matic Carotid Surgery Trial, which will try to answer the question: which soft or heterogen plaque with more than 25 % echolucent material indicates carotid endarterectomy[9].

Taking into account results of all these studies, the need for successful and efficient early detection of atherosclerotic carotid stenosis has been imposed. The significance of early detection is reflected in the fact that both doctor and patient are aware of presence of the disease. Risk factors modification which can be managed is possible (arterial hypertension, diabetes mellitus, smoking, hypercoagulable states). Medical treatment can be started (antithrombotic agents, hypolipemic drugs, antioxidants).

Early detection of carotid artery disease in general population is ineffective and very expensive. It is well known that in the randomized prevalence of severe carotid stenosis is infrequent; significant carotid artery stenosis in the atherosclerosis risk factors patients is very frequent [14]. Other groups (elder than 65 years, present or previous cerebrovascular disease) with higher frequency of carotid occlusive disease risk have been identified [2,7,18].

Identification of patients with asymptomatic carotid stenosis appears 1. As accidental findings during the routine auscultation of carotid arteries, or 2. Within the framework of screening program in search of carotid stenosis in high-risk patients.

Carotid bruits are caused by flow disturbances in the carotid artery. It is not always easy for the physician to distinguish the transmitted murmur of valvular disease (aortic stenosis) from that associated with the turbulence of carotid stenosis. Heart murmurs are usually heard bilaterally and in all positions in the neck. Bruits originating in the carotid artery are usually heard in the neck and may be unilateral. Other conditions can be presented with mid cervical murmurs: venous hums, anemia, hyperthyreosis, are not so rare. That is the reason why physician subsequently will refer patient with mid cervical bruit to the vascular laboratory for further evaluation.

Carotid bruit is not reliable indicators of severe carotid artery stenosis. Approximately 60% of patients with bruit have some carotid disease: only 35% of patients with bruit have haemodynamically significant disease. Of all patients with haemodynamically significant stenosis, only 50% have bruits [3].

The presence of a carotid bruit is most predictive of myocardial infarction, not an ipsilateral stroke. Therefore, carotid bruit should alert the examiner to generalized atherosclerotic disease (especially coronary artery disease) not just carotid artery disease.

## **THE AIM OF THE STUDY**

1. Determine the frequency of asymptomatic carotid bruit in patients with atherosclerotic occlusive disease of the lower extremities,
2. To establish characteristics of asymptomatic carotid bruit based on physical examination and color-flow duplex scanning.
3. Do answer the question, whether limiting screening of carotid stenosis to the subgroup of patients with carotid bruit can be effective and justified.

## **PATIENTS AND METHODS**

The study group includes analysis of 109 patients treated for with atherosclerotic occlusive disease of the lower extremities at the vascular department Surgical Clinic Nis and Institute for cardiovascular disease "Dedinje" in Belgrade. Mean age was 63,25 years. Male to female ratio was 88 to 21. Indication for hospitalization, related to severity of clinical stage of atherosclerotic occlusive disease of the lower extremities was the following: 19 patients with claudication, 64 with rest pain, and 26 with ulcer or gangrene. Following patients did not evaluate: patients with symptomatic carotid artery disease, with no atherosclerotic carotid disease, with previously carried out carotid arteriography or endarterectomy, those immediately operated for acute peripheral vascular disease (e.g. emboli, acute thrombosis). In all patients angiologic and angio – neurologic examination were performed.

Auscultation of carotid arteries was performed in a uniform manner using a stethoscope bell in a quiet environment with the patient reclining, his neck extended 30 degrees and his breath held in inspiration. Further laboratory, non-invasive investigations excluded other cause of bruit than that one originating from carotid artery disease.

The primary examination was carried out with the aim of detecting the frequency of asymptomatic carotid stenosis in patients with atherosclerotic occlusive disease of the lower extremities. Color Doppler duplex scans reveals: 1. Severity of stenosis in percentage (Doppler signal and spectral analysis based on ACAS criterion), and 2. Plaque morphology characteristics (using B-mode): plaque structure and plaque surface characteristics. According to Gray Weale classification there are four different carotid plaque types: I lipid (echolucent with thin echogenic cap), II lipofibrous (substantially echolucent), III fibrolipid (dominantly echogenic) and type IV fibrous (homogenous echogenic) [8].

Following primary and before secondary examination two groups of patients were defined: the examined with carotid artery stenosis  $\geq 60\%$  (40 patients), and the controlled one with carotid artery

stenosis < 60% (69 patients). These two groups were compared in terms of carotid bruit.

Statistical analyses consist of Student t-test,  $\chi^2$  test. Probability that different factors independently influenced the presence of carotid artery stenosis is estimated with multivariate logistic regression analysis. The results were considered significant if  $p < 0.05$ .

## RESULTS

Of 109 neurologic asymptomatic patients treated for symptomatic lower limb ischaemia, and 218 auscultated carotid arteries, carotid bruit was detected in 57 patients (52.3%).

Physical characteristics of the asymptomatic bruit revealed that in 40 patients carotid bruits were detected bilaterally (71,9%), in 16 (28.1%) unilaterally, with prevalence of right side, in 62.5% of patients. In all but two patients punctum maximum of the bruit was within mid-cervical area. The vast majority of bruits were moderate to rough, detected during auscultation over 75 carotid arteries. Bruit characteristics were tabulated in the table 1.

**Table 1.**  
**Asymptomatic carotid bruit characteristics in 57 patients (114 carotid arteries)**

Quality of the bruit	Number of auscultated carotid arteries	Percentage (%)
Smooth	21	18.42
Moderate	46	40.36
Rough	29	25.44
Noisy	2	1.75
Absent	16	14.03
Total	114	100

Haemodynamically characteristics of carotid artery stenosis in patients with and without carotid bruit were examined by means of duplex scan

(Doppler signal and spectral analysis) according to criterion of ACAS (table 2).

**Table 2.**  
**Carotid artery diameter stenosis related to presence of carotid bruit**

Carotid artery	Asymptomatic carotid bruit		
	Present	Absent	Total
Bilateral < 60%	22	47	69
Unilateral $\geq$ 60%	17	3	20
Bilateral $\geq$ 60%	18	2	20
TOTAL	57	52	109

Carotid artery diameter stenosis related to auscultation quality of the bruit was showed in table 3.

Of 109 neurologic asymptomatic patients in 40 (36,69%) there was haemodynamically significant carotid artery stenosis  $\geq$  60 % or occlusion, and in 32 patients (29%) stenosis  $\geq$  70% or occlusion. Out of 40 patients with asymptomatic carotid stenosis  $\geq$  60 % carotid bruit was presented in 35, which was statistically significant ( $p < 0.001$ ).

As the frequency of asymptomatic carotid stenosis in patients with atherosclerotic occlusive disease of the lower extremities is high, secondary analysis is performed in order to answer the following question: is limited screening of the asymptomatic carotid artery stenosis to the specific subgroups of patients worthwhile.

Multivariate logistic regression analysis confirmed the correlation between carotid bruit and asymptomatic carotid artery stenosis ( $t = 0.50$ ;  $p = 0.01$ ). In other words probability that asymptomatic carotid bruit influenced the prevalence of carotid artery stenosis equal or greater than 60% was confirmed. Sensitivity of a carotid bruit in predicting carotid artery stenosis equal or greater than 60% was 67%, with specificity of 56%.

**Table 3.**  
**Carotid artery diameter stenosis related to quality of the bruit**

Quality of the bruit	Carotid artery diameter stenosis				
	< 50%	50-59%	60-79%	80-99%	100%
Smooth	4	17	-	-	-
Moderate	6	23	16	1	-
Rough	-	2	23	4	-
Noisy	-	-	-	2	-
Absent	9	-	-	-	7
Total	19	42	39	7	7

## DISCUSSION

It is a well known fact that annual rate risk for TIA, RIND, or frank stroke in patients with asymptomatic carotid artery stenosis depending on steno-

sis severity and plaque characteristics is 5 – 18% [13,16]. On the other hand, vascular surgeons perform carotid endarterectomy for asymptomatic stenosis with low mortality and morbidity rate (0 – 3 %) [4,12]. Two large multicentric prospective studies (Department of Veterans Affairs Hospital

Carotid Trial and ACAS) revealed the advantages of surgical treatment of carotid artery stenosis in comparison with best medical treatment [5,10]. Taking this into account it is indispensable to define a rational approach to early detection of asymptomatic carotid stenosis. General population examination aimed at early detection is ineffective and very expensive [14]. Therefore it is worthwhile to define the subgroups of patients with high risk for significant asymptomatic carotid artery stenosis [2,14,18]. This fact is emphasized in countries with low health budget, especially in these ones in transition.

For many years, it has been recommended that the screening physical exam include listening with stethoscope over the neck in the area of the extracranial carotid arteries. Results of the Framingham study showed that mortality caused by stroke in patients with asymptomatic carotid bruit was 1.9% [19].

Various authors, depending on peripheral vascular disease characteristics, indicated different frequencies of asymptomatic carotid artery bruit from 25-45% [6,11]. Gentile and coworkers showed that 62 patients (28%) of the 225 patients who underwent infrainguinal bypass surgery had a carotid bruit detected at the time of carotid artery duplex examination. Of these 62 patients with bruits, 36 (58%) had asymptomatic carotid stenosis of 50% or greater, whereas 29 (18%) of 163 patients without carotid bruit had asymptomatic carotid stenosis of 50% or greater. The presence of carotid bruit was strongly associated with carotid stenosis by univariate and multivariate analysis. Despite this association, only 28% of patients had carotid bruit and 29 (45%) of the 64 patients with carotid stenosis of 50% or greater had no bruit [7]. Our study revealed similar results. Of 109 patients with limb ischaemia

asymptomatic carotid bruit was present in 57 (52.29%). Almost in 70% of patients moderate or rough bruit was detected on both sides. Asymptomatic carotid bruit is significantly associated with atherosclerotic occlusive disease of the lower extremities estimated by univariate and multivariate analysis. However, sensitivity (to reveal the existing disease) was 67 %, and specificity (no disease was present, or bruit was detected) was 56 %. According to this limiting screening of asymptomatic carotid artery stenosis in the subgroup of patients with asymptomatic carotid bruit is unreliable and ineffective. Nearly, in that way, one third of patients would be excluded from early detection of asymptomatic carotid artery stenosis.

#### **CONCLUSION**

1. In patients with symptomatic atherosclerotic occlusive disease of lower extremities frequency of carotid bruit is 52.3%,
2. The vast majority of bruits were moderate to rough (66%), bilateral (70%), within mid-cervical area (96%).
3. In 87.5% of patients with duplex scanning detected carotid artery stenosis  $\geq 60\%$ , carotid bruit was recorded.
4. The presence of carotid bruit was strongly associated with carotid artery stenosis by univariate and multivariate analysis. Unfortunately sensitivity of a carotid bruit in predicting carotid artery stenosis  $\geq 60\%$  was 67%, with specificity of 56%.
5. Limiting screening of significant carotid artery stenosis in neurological asymptomatic patients with symptomatic atherosclerotic occlusive disease of lower extremities to the subgroup of patients with carotid bruit is not effective.

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