INTERNATIONAL JOURNAL OF
CLINICAL NEUROSCIENCES
AND MENTAL HEALTH

ORIGINAL RESEARCH

Screening of cerebrovascular diseases in Stroke Prevention Centres in Latvia

Galina Baltgaile[1], Tatjana Timofejeva[2], Ženija Kovaldina[3], Anita Raita[4], and Jelena Pecherska[5]

Special Issue on Neurosonology and Cerebral Hemodynamics

Abstract

Background: To improve stroke prevention, the observation of patients suspected on having cerebrovascular disease (CVD) or stroke risk factors has been carried out in Stroke Prevention Centres (SPC) in Riga. The analysis of the incidence of CVD, correlations of clinical symptoms with diagnostic findings and risk factors was performed.

Methods: 1102 outpatients aged 7-89 years (65% female, 35 % male) underwent color-coded duplex sonography of precerebral and cerebral blood vessels (CCDS), had checked brachial blood pressure and blood test. Vascular pathology detected by CCDS was confirmed by CT angiography. Some of patients underwent X-ray, EEG, CT scan or MRI examination.

Results: Isolated dyslipidemia was the reason for observation in 2% of cases only, although 56% of surveyed had registered high level of cholesterol at the moment of observation or in the past. Patients with arterial hypertension (14% of all) had atherosclerotic lesions in arteries in 42% of cases. From 22% of patients with vertiginous syndromes and tinnitus CVD was proved in 5% of cases. Vascular pathology in cases of headache (18% of all) was found in only 11%. Silent atherosclerotic process in pre-cerebral arteries was suspected in 15% of patients but proved in 27% of all surveyed.

Conclusion: The underestimation of dyslipidemia and arterial hypertension as a stroke risk factors and the mismatch of diagnoses in patients with unspecified vestibular disorders and headache was found. The prevalence of detected silent carotid stenoses from all suspected proved the efficacy of US vascular screening in prevention, detection and follow-up of CVD.

Keywords: Stroke prevention, Stroke risk factors, Cerebrovascular diseases, Stenosis of precerebral and cerebral arteries, Vascular ultrasound screening, Vestibular disorders, Headache.

[1]Department of Neurology, Medical clinic "ARS", Latvia
[2]Department of Neurology, Medical Centre "VC-4", Latvia
[3]Department of Functional Diagnostic, Austrumu Clinical Hospital, Latvia
[4]Department of Neurology, Pauls Stradins Clinical University Hospital, Latvia
[5]Department of Modelling and Simulation, Riga Technical University, Latvia

Correspondence: Galina Baltgaile
Medical Hospital "ARS", Skolas 5, Riga, Latvia
Email adress: baltgaile@gmail.com

Citation: Baltgaile et al. Screening of cerebrovascular diseases in Stroke Prevention Centres in Latvia. IJCNMH 2014; 1(Suppl. 1):S10

Received: 09 Sep 2013; Accepted: 25 Nov 2013; Published: 09 May 2014

Introduction

Diseases of the heart and circulatory system (cardiovascular disease or CVD) are the main cause of death in developed countries, an important cause of disability and a source of large economic and social cost to the society. In the Central and East European (CEE) countries, coronary heart disease (CHD) and stroke were responsible for 49 percent and 32 percent of all CVD deaths, respectively [1]. In the period from the 1980s through the 1990s, Europe experienced a large political transformation which worsened significantly health indicators in Western Europe as a whole and in Latvia in particular, creating a large life expectancy gap between the West and East of the continent [2]. Despite the fact that after 1998 CVD mortality started to decrease in Latvia, it is still one of the highest in European Union [3]. A recent study of neurological stroke care in Europe based on statistic data has provided evidence that stroke as a cause of death ranks second in the Baltic States. Stroke mortality rate in Latvia is one of the highest in EU [4].

There were no epidemiological studies of cerebrovascular diseases based on standardized methods of data collection in Latvia. The only source of information about some risk factors of CVD in Latvian population was the European Health For All Database [3]. Incomplete data about arterial hypertension, obesity and dyslipidemia in Latvian population from the World Health Organization (WHO) statistics database are limited to the year 2004. The only national cross-sectional survey of cardiovascular risk factors based on computerized random sampling from the registry of Latvian population was carried out in 2012 by Latvian Research Institute of Cardiology [5].

The levels of cardiovascular risk factors in Latvia were found to be relatively high. Of all the respondents, 75.2% had an increased total cholesterol level. Hypercholesterolemia was found in almost 56% of men and 41% of women in the age group of 25-34 years. Arterial hypertension was identified in 44.8% of the respondents. This study showed that control of hypertension and dyslipidemia was definitely below expectations, which was mainly due to a combined effect of poor population awareness and poor compliance with medication.

With such high frequency of dyslipidemia and arterial hypertension, high rates of arterial atherosclerotic lesions can be expected. There were no available data on the incidence of silent atherosclerotic disease of coronary and brain supplying arteries in Latvian population, although regular ultrasound vascular examinations revealed frequent occurrence of arterial atherosclerotic lesions. All above mentioned facts prove the insufficiency and inadequacy of stroke and coronary artery diseases prevention in Latvia.

One way to improve stroke prevention in Latvian population was to determine the incidence of cerebrovascular diseases, the correlation of clinical symptoms with arterial atherosclerotic lesions in brain supplying arteries and cerebrovascular risk factors.

The first and important part of study was to discover and analyze the weaknesses in recognition of stroke and other cerebrovascular diseases symptoms by family doctors, other medical specialists and among the public. Despite the fact that knowledge of the nature of atherosclerotic disease, its prevention and treatment increased in recent decades, the recognition of this disease still remains poor. For that purpose the analysis of clinical and diagnostic data of patients observed and followed in Stroke Prevention Centres (SPC) in Riga has been performed in the period of September 2012-March 2013

Methods

Four stroke prevention centres in Riga were based on the two biggest out-patient clinics and out-patient departments in two clinical hospitals. The requirements for stroke prevention centres were: availability of consultant neurologist experienced in cerebrovascular diseases, experienced neurosonologist, up-to-date ultrasound Duplex scan diagnostic, easy access to X-Ray, CT scan, MRI, EEG diagnostic and clinical laboratory, common protocol of patients observation and program database in all centres.

Due to the mass media advertising campaign for stroke prevention, patients suspected of having cerebrovascular disorders or stroke risk factors have been sent to SPC not only by family doctors or other medical specialists but also through direct patient access.

All out-patients consulted by neurologist underwent US examination of precerebral and cerebral blood vessels by routine extra and transcranial Color Coded Duplex Doppler Scan program performed by using premium class machines ("iE-33" Philips and "Applio" Toshiba). Standard US examination protocol was supplemented by monitoring of cerebral circulation during half an hour in cases of suspected microemboli and registration of arterial wall elastic properties by M-mode scan. Some patients with suspected pathology in brain or spine underwent X-ray, CT scan or MRI examination. Vascular pathology was confirmed by CT angiography in 97% of cases with significant degree of arterial stenosis or cerebral arteries pathology. EEG was performed in all cases of seizures. Almost all observed patients had checked brachial blood pressure and blood test for cholesterol fractions.

From 1400 observed patients 288 had been excluded from analysis because of incomplete data. Statistical analysis of clinical-diagnostic correlations of 1102 patients has been performed.

Results

The age distribution between 772 observed women and 330 men showed a small prevalence of men in younger age groups (**Figure 1**). There was a larger number of male

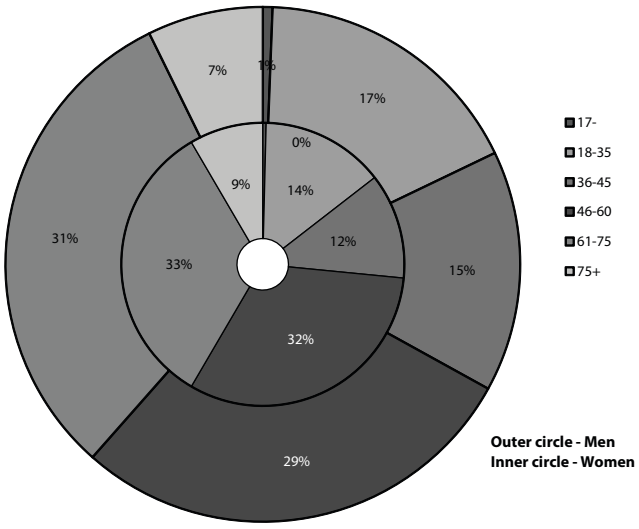

Figure 1. Patients distribution by sex and age.

patients aged 18-45 years referred to SPC compared to the group of 46-60 years.

The main complaints from younger patients (18-35 years) were headache, vertigo and vertiginous syndromes, tinnitus. The incidence of cerebrovascular pathologic findings in this group was low: increased intima media thickness (IMT) was found in 6% and premature atherosclerosis manifested as insignificant atherosclerotic plaques (<30% of lumen) in 2% of cases (**Figure 2**). Interestingly, increased levels of cholesterol and triglycerides accompanied these findings in only 4% of cases. Arterial hypertension was found in 12% of young patients and was accompanied by changes in arterial wall elastic properties in most cases (78%).

The progression of IMT and atherosclerotic plaques in neck arteries with age was observed in all patients except the eldest. The incidence of increased IMT and insignificant atherosclerotic plaques in older age patients (more than 75 years) was slightly lower than in patients aged 61-75 years. Incidence of dyslipidemia was proportionally increased with age, except age group 46-65 years where the frequency of increased cholesterol and triglycerides was the highest (**Figure 2**).

This proportional increase of plaques size with age was not found in cases of cerebral stenoses. The occurrence of cerebral stenotic lesions was the same in three first age groups and slightly higher in patients older than 60 years (**Figure 2**). This disproportion could be partly explained by technical inaccuracy of US measurement of degree of stenoses in cerebral arteries.

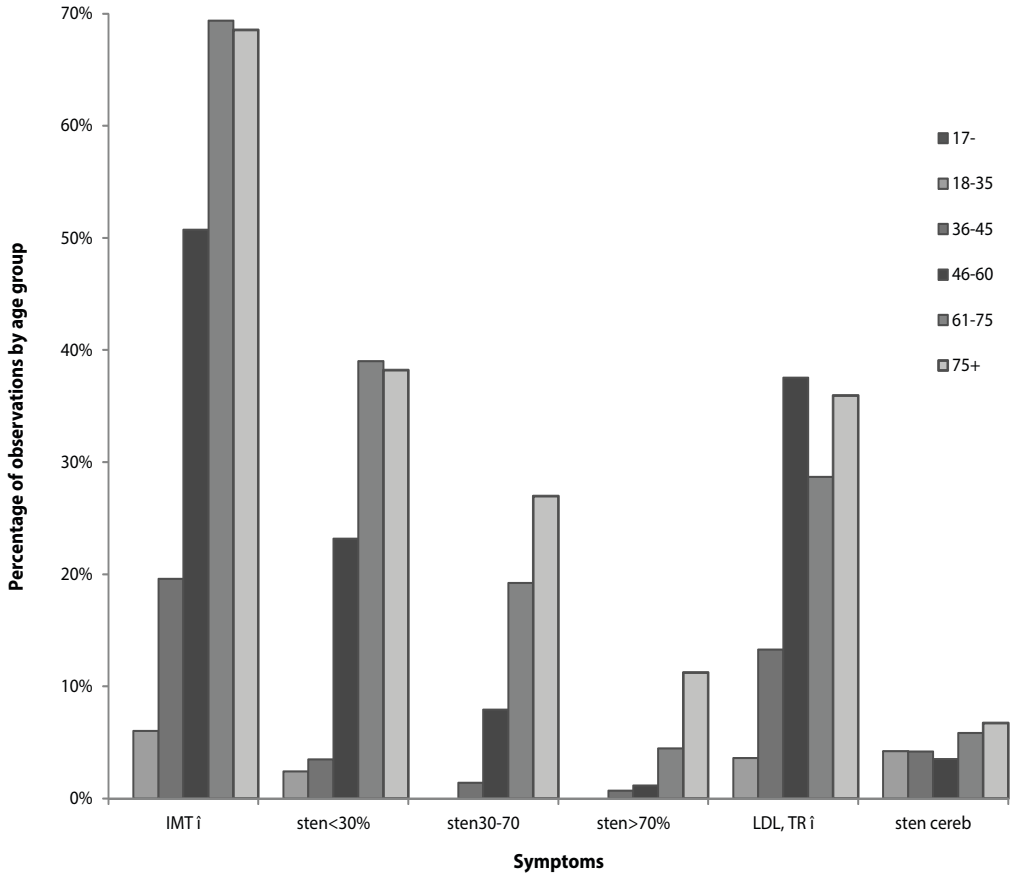

Figure 1. Distribution of increased intima-media thickness, stenotic lesions in pre-cerebral and cerebral arteries, dyslipidemia between patients of different age groups (from 17 to 75+ years).

IMT î = Increased intima media thickness; sten <30% = Stenoses less than 30% of arterial lumen; sten 30-70% = Stenoses 30-70% of arterial lumen; sten >70% = Stenoses more than 70% of arterial lumen; LDL, TR î = Increased low-density lipoproteins and triglycerides; sten cereb. = Stenoses of cerebral arteries

The analysis of suspected and proved cerebrovascular pathology showed the main mismatches (**Figure 3**). Dyslipidemia as the isolated pathology was the reason to send patients to observation in 2% of cases only. Meanwhile it was found as the only pathology in 6% of patients and as accompanying sign of atherosclerotic arterial lesions in 26% of patients. Additionally, 24% of all surveyed had registered high level of cholesterol and triglycerides in the past. Surprisingly low number of patients with primary or secondary hypertension was sent to SPC (in 14% of surveyed), although the vascular pathology was found quite frequently in this group—arterial hypertension accompanied atherosclerotic arterial lesions in 42% of cases. The silent atherosclerotic process in precerebral arteries was suspected in 15% of patients but proven in 27% (**Figure 3**).

One of the most represented group in the survey consisted of patients complaining on disorders of vestibular function as the only symptoms (22%): vertigo and vertigi-

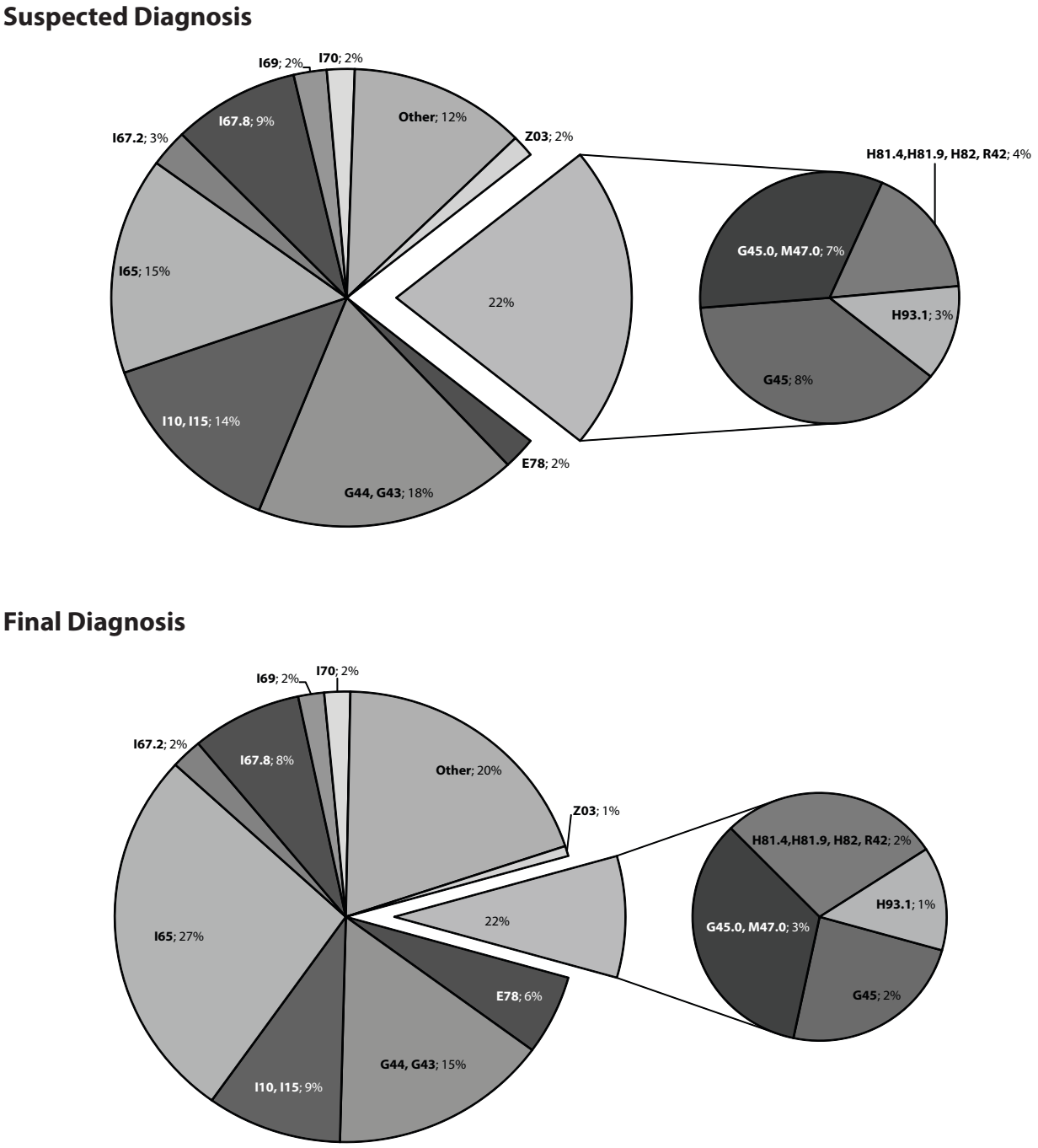

Figure 3. Suspected and confirmed disease or pathologic condition.
International codes of diseases [6]: E78 - Dyslipidemia – as an only suspected and found pathological condition; G43, G44 - Migraine and other headache syndromes; G45 - Vertebrobasilar artery syndrome; G45.0, M47.0 - Anterior spinal and vertebral artery compression syndromes; H81.4, H81.9, H82, R42 -Disorders of vestibular function, Vertiginous syndromes, Dizziness and giddiness; I10, I15 - Essential (primary) hypertension, Secondary hypertension; I65 - Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction; I67.2 - Cerebral atherosclerosis; I67.8 - Other specified cerebrovascular diseases; I69 - Sequelae of cerebrovascular disease; I70 – Atherosclerosis; Z03 - Medical observation and evaluation for suspected diseases and conditions; Other - Other.

nous syndromes, dizziness, giddiness and tinnitus. Vertebro-basilar artery syndrome, transitory ischemic attacks and stroke in vertebrobasilar territory, as well as vertebral artery compression syndromes were suspected in 15% of cases. These suspicions were proven in a surprisingly rare number of patients—5% (**Figure 3**). Different degrees of significant stenotic lesions in vertebrobasilar arteries separately or combined with hypoplasy were found in 20% of patients with proven pathology, and insignificant arterial stenotic lesions in 37% of cases (**Figure 4**). Vertebral artery compression was proven just in 2 cases, subclavian steal syndrome in 3 cases. The rest of patients with vestibular disorders had a wide spectrum of variable pathological conditions—from iron deficit anemia to benign paroxysmal postural vertigo without documented abnormality in arterial and venous cerebral circulation.

Another widely represented group consisted of patients with acute or chronic headache (18% of all surveyed subjects). Vascular pathology was found in 11% only (**Figure 3**). There were a few quite significant findings detected like arteriovenous malformation in posterior artery territory, venous sinus thrombosis and vertebral artery dissection. Altered cerebral blood flow without local lesion was observed in a minority of patients with headache (7%). These findings were accompanied by arterial hypotension or iron deficiency anemia or abnormality in electrical brain activity. Increased cerebral blood flow velocity remained unexplained in 4 cases.

Good correlation between suspected and found stenotic lesions of the precerebral and cerebral vessels was observed in patients sent to SPC with suspected stenosis of precerebral arteries, not resulting in cerebral infarction, as well as cerebral atherosclerosis and sequels of cerebrovascular diseases (**Figure 4**).

Discussion

The higher prevalence of young male patients aged 18-45 years compared to the 46-60 years males, more suspicious of having CVD, could be partly explained by increased awareness of the disease and as a consequence, a greater concern for their health .The further analysis of complaints and findings in a group of young people aged 18-35 years frequent occurrence of symptoms mistakenly considered as signs of CVD.

Large number of surveyed subjects registered high level of cholesterol in the past or at the moment of observation. All together these findings (56%) were less frequent than previously reported [5], which could be partly explained by difference in cohorts (selected patients with a small proportion of self-referred in this study contrary to population based cross sectional study). Another explanation is the surprisingly small number of patients with dyslipidemia as an only sign (2%) sent for observation. The fact that from the majority of the 32% of observed patients with dyslipidemia had different degrees of atherosclerotic

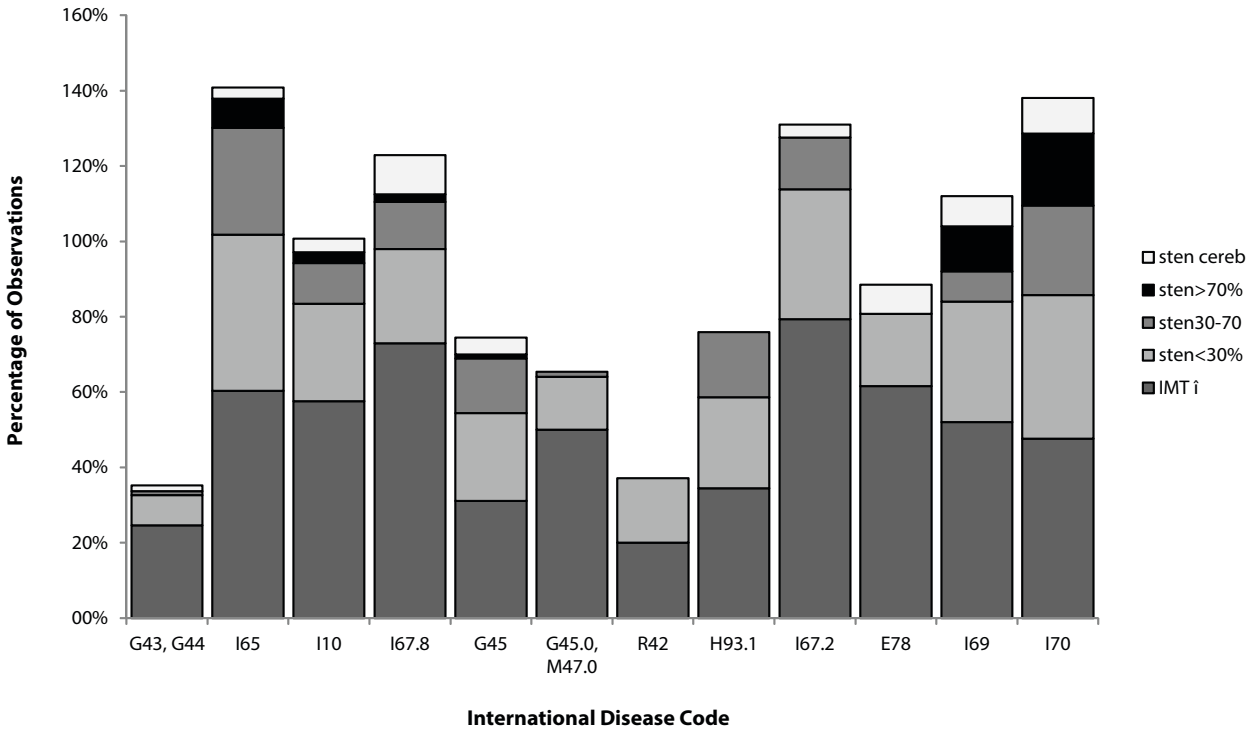

Figure 4. Distribution of increased IMT and vascular sclerotic lesions according to suspected disease or pathological condition.
International Diseases codes are the same as in Figure 3. Notations are the same as in Figure 2.

lesions in arteries must prompt more awareness and suspicion on the role of this risk factor in silent vascular pathology. Especially concerning the group aged 45-60 years, with the highest frequency of dyslipidemia.

Arterial hypertension was found in the youngest patients with the same frequency as arterial hypotension. In both conditions changes in arterial wall elastic properties presented as impaired dystensibility/stiffness of arterial wall were found in most cases, which could help as an early risk factor for vascular pathology. The growing frequency of arterial hypertension in patients aged 36-60 years, together with high level of dyslipidemia matched with growing occurrence of stenotic lesions in precerebral arteries, proving the important role of these pathologic conditions as main factors for developing vascular pathology. The only disagreement was found in older patients aged 61-75 years where occurrence of arterial hypertension and hypercholesterolemia was less than that found in age group 46-60 years, but the presence of high-grade atherosclerotic stenotic lesions in precerebral and cerebral arteries was much higher. These findings have to be analyzed in comparison with the course of antihypertensive therapy and use of statins.

The main mismatch between suspected and confirmed vascular pathology was found in patients with unspecific disorders of vestibular function, vertigo and vertiginous syndromes sent to SPC by family doctors with suspicions of transient ischemic attack (TIA) in vertebrobasilar territory and vertebral artery compression due to cervical spondylosis. Vestibular function disorder as well as tinnitus and headache were the main complaints of who patients contacted SPC themselves. The low frequency of documented vascular pathology in this group indicated the need of more educational programs for medical professionals and population with the description of initial symptoms and the course of stroke and cerebrovascular diseases. Rare serious vascular pathology manifested as headache, accompanied by vestibular disorders which proves the benefit of transcranial color-coded duplex (TCCD) screening of arteries in these patients.

The highest correlation between suspected and found arterial stenotic lesions was defined in a well represented group of patients with occlusion and stenosis of precerebral arteries without cerebral infarction, with chronic cerebral ischemia and stroke or TIA. This match proves the role in screening and follow-up of cerebral hemodynamics by TCCD in cases of silent carotid stenoses, chronic cerebral ischemia, TIA and stroke.

Only 5% of all patients having vascular pathology and 2% of those who underwent endovascular procedures or endarterectomy revisited Stroke Prevention Centres to control the atherosclerotic stenoses of precerebral and cerebral arteries and revise the treatment. Most of these patients had controlled arterial tension and level of cholesterol and stable vascular condition with no further progression. The follow-up of therapy resistant growing atherothrombotic plaques allowed to send patients for surgical treatment in time.

All our data demonstrate the need to control the dynamics of arterial pathology apart from the control of risk factors. The easily performed and non-invasive TCCD is quite often the only source of information on the dynamics of the pathological process, therapeutical effect on cerebral circulation and collateral compensating flow, which is extremely important for the prognosis and treatment tactic.

Abbreviations

CEE: Central and East European; CHD: Coronary heart disease; CVD: Cardiovascular disease; IMT: Intima media thickness; SPC: Stroke Prevention Centres; TCCD: Transcranial color-coded duplex; TIA: Transient ischemic attack; WHO: World Health Organization

Competing interests

The authors declare no conflict of interest.

References

1. Allender S, Scarborough P, Peto V, Rayner M, Leal J, Luengo-Fernandez R, Gray A. European cardiovascular disease statistics, 2008 edition. British Heart Foundation; 2008. Available from: http://www.bhf.org.uk/publications/view-publication.aspx?ps=1001443 (Accessed 23 April, 2012).
2. Pająk A, Kozela M. Cardiovascular Disease in Central and East Europe. Public Health Reviews 2012; 33:416-35.
3. World Health Organization Regional Office for Europe. European Health for All Database (HFA-DB). WHO Europe; 2011. Available from: http://www.euro.who.int/en/what-we-do/data-and-evidence/databases/european-health-for-all-database-hfa-db2 (Accessed 23 April, 2012).
4. Branin M, Bornstein N, Boysen G, Demarin V. Acute neurological stroke care in Europe; results of the European Stroke Care Inventory. Eur J Neurol 2000; 7(1):5-10.
5. Ērglis A, Dzērve V, Pahomova-Strautiņa J, Narbute I, Jēgere S, Mintāle I, Ligere R, Apinis P, Lejnieks A, Misiņa D, Rozenbergs A. A Population-Based Cross-sectional study of Cardiovascular Risk Factor in Latvia. Medicina (Kaunas) 2012; 48(6).
6. World Health Organization. WHO classifications, International classification of diseases (ICD), ICD -10 online version:2010. Available from: http://www.who.int/classifications/icd/en.