BRIEF COMMUNICATION

Size of low-density lipoprotein particles in patients after stroke

Andrej Dukát[1], Stanislav Oravec[1], Peter Gavorník[1], Martin Wawruch[2], Peter Sabaka[1]

1 2nd Department of Internal Medicine, Comenius University in Bratislava, Bratislava, Slovakia
2 Institute of Pharmacology, Comenius University in Bratislava, Bratislava, Slovakia

Introduction Acute stroke is a severe clinical manifestation of atherothrombosis. Atherothrombosis and its complications are currently the most frequent cause of morbidity in the world. The major factors contributing to accelerated atherothrombosis in humans are dyslipoproteinemias and hypertension, among others. The presence of atherogenic lipoproteins in plasma leads to the development of endothelial dysfunction, increases the vessel tone, and contributes to further deterioration of cerebral perfusion leading to cerebral ischemia. The aim of the present study was to evaluate atherogenic lipoproteins in patients with acute ischemic stroke admitted to the intensive care unit.

Patients and methods We followed up 50 consecutive patients with acute ischemic stroke (24 men and 26 women), aged from 35 to 90 years (mean age, 77.5 years ±11.8 years), and admitted to the 2nd Department of Internal Medicine of the Comenius University in Bratislava, Slovakia. The diagnosis of stroke was confirmed by a neurologist and by computed tomography. After admission, blood samples from the cubital vein were collected to measure routine biochemical parameters, including complete lipid profile in EDTA-K2 plasma.

Lipid parameters included plasma total cholesterol and triglycerides measured by the enzymatic CHOD-PAP method (Roche Diagnostics, Germany). For the determination of a nonatherogenic lipoprotein phenotype A and an atherogenic lipoprotein phenotype B, the Lipoprint LDL system was used (Quantimetrix, United States). The score of atherogenic risk (SAR) was calculated as the rate of nonatherogenic to atherogenic plasma lipoproteins. The SAR over 10.8 characterized a nonatherogenic lipoprotein profile, while the SAR less than 9.8 characterized an atherogenic lipoprotein profile.[1,2]

The obtained lipid results were compared with those of the control group, which consisted of 93 medical students of the Comenius University.

The statistical analysis was performed using the *t* test for unpaired variables. A *P* value less than 0.005 was considered statistically significant.

Results Plasma lipid levels, lipid subfractions, and the SAR of patients with stroke and controls are presented in the TABLE.

Patients with acute stroke had significant disturbances in the lipid profile when admitted to the hospital. They had significantly higher plasma lipids (cholesterol and low-density lipoprotein [LDL] cholesterol) and lower high-density lipoprotein cholesterol levels compared with the control group. They also showed high prevalence of atherogenic lipoprotein profile of type B.

Discussion Acute stroke is a severe condition. In Slovakia, the rate of stroke is nearly 10,000 of new cases a year. Mortality is rather high, and of 50,000 patients who survive, 30% suffers severe, long-lasting deterioration of health. Treatment during hospital stay and after discharge is still expensive. Expenditure constitutes about 1% of the gross national product. Hypertension, smoking, diabetes, and dyslipidemia are the major risk factors that can be modified.[3,4]

A new laboratory method, the Lipoprint LDL system, quantifies lipoproteins and specifies the types of lipoprotein profile in the examined subjects: atherogenic vs. nonatherogenic.[5-7]

For clinical practice, it is useful to estimate the SAR. It represents the ratio of nonatherogenic to atherogenic lipoproteins in serum. Good correlations were found between SAR and lipoprotein profiles estimated with Lipoprint LDL.[8,9] The SAR is a newly introduced score that can help assess the atherogenic risk in patients. It is going to be tested in further clinical studies. Its predictive

Correspondence to:
Prof. Andrej Dukát, MD, PhD, FRCP,
2nd Department of Internal Medicine,
Comenius University in Bratislava,
Mickiewiczova 13, 813-69 Bratislava,
Slovakia, phone: +421-257-290-329,
fax: +421-257-290-785,
e-mail: andrej.dukat@faneba.sk
Received: April 16, 2012.
Conflict of interest: none declared.
Pol Arch Med Wewn. 2012;
122 (Suppl 1): 30-31

TABLE Plasma concentrations of lipids, lipoproteins, and the score of atherogenic risk

	Controls, n = 93	Patients, n = 50	*P*
cholesterol, mmol/l	4.42 ±0.81	5.42 ±1.12	<0.0001
TG, mmol/l	1.42 ±0.73	2.31 ±0.91	<0.0001
VLDL, mmol/l	0.67 ±0.21	1.11 ±0.34	<0.0001
LDL 1,2, mmol/l	1.38 ±0.44	1.71 ±0.57	<0.0003
LDL 3–7, mmol/l	0.018 ±0.018	0.31 ±0.23	<0.0001
LDL, mmol/l	2.43 ±0.61	3.08 ±0.83	<0.0001
HDL, mmol/l	1.26 ±0.31	1.09 ±0.32	<0.001
SAR	44.2 ±20.3	7.52 ±5.5	<0.001

Data are presented as mean ± standard deviation.

Abbreviations: HDL – high-density lipoprotein, LDL – low-density lipoprotein, SAR – score of atherogenic risk, TG – triglicerydes, VLDL – very-low-density lipoprotein

value is high; therefore, it is expected to be particularly useful in clinical practice.[10,11]

Nowadays, we are confronted with new clinical-diagnostic reality, represented by the phenomenon of "atherogenic normolipemia" as shown by the results obtained in the control group. This enlarges the risk group of patients with premature development of atherosclerosis.[5,12]

The differentiation between atherogenic (phenotype B) and nonatherogenic (phenotype A) lipoprotein profile is based on the presence of these lipoprotein entities in blood plasma/serum.[13] Atherogenic spectra are abundant in very-low-density lipoprotein, intermediate-density lipoproteins, and, especially, of small-dense LDL (sdLDL). These are strongly atherogenic LDL particles representing an LDL subfraction 3–7. Their diameter is smaller than 26.5 nm (265 Angström) and they flow in density diameter between 1.048 and 1.065 g/ml.[14] The above biological and biochemical characteristics result in strong atherogenic properties of these lipoproteins.[15]

In conclusion, patients with acute stroke may constitute a severe diagnostic and therapeutic challenge due to comorbidities, including dyslipoproteinemias. All diagnostic and therapeutic approaches are expensive and time-consuming.

Another modifiable risk factor in this patient group is dyslipidemia. It is common in patients with stroke, which affects their poor outcome. High prevalence of dyslipoproteinemias is also observed in other severe cardiovascular diseases such as coronary heart disease or peripheral arterial disease.

Thus, early hypolipidemic treatment with statins is indicated also among patients with acute stroke as an important part of their complex management. Because the high proportion of patients reveals the presence of sdLDL, not only monotherapy with statins but also combination therapy (statins plus fenofibrate or statins plus niacin) may be indicated. This can lead to the improvement in the endothelial function as well as cerebral blood flow in patients with acute stroke.

REFERENCES

1 Austin MA, King MC, Vranizan KM, Krauss RM. Atherogenic lipoproteine phenotype. A proposed marker for coronary heart disease risk. Circulation. 1990; 82: 495-506.

2 Van J, Pan J, Charles MA, et al. Atherogenic lipid phenotype in a general group of subjects. Arch Pathol Lab Med. 2007; 131: 1679-1685.

3 Superko HR. Advanced lipoprotein testing and subfraction are clinically useful. Circulation. 2009; 119: 2383-2395.

4 Sacks FM, Campos H. Clinical review 163: Cardiovascular endocrinology: Low-density lipoprotein size and cardiovascular disease: a reappraisal. J Clin Endocrin Metabol. 2003; 88: 4525-4532.

5 Rizzo M, Berneis K. Low-density lipoprotein size and cardiovascular risk assessment. QJM. 2006; 99: 1-14.

6 Endres M, Heuschmann PU, Laufs U, Hakim AM. Primary prevention of stroke: blood pressure, lipids, and heart failure. Eur Heart J. 2011; 32; 545-552.

7 O'Donnell MJ, Xavier D, Liu L, et al. Risk factors for ischaemic and intracerebral haemorhagic stroke in 22 countries: a case-control study. Lancet. 2010: 376: 243-249.

8 Oravec S. [New laboratory medicine tool for the diagnosis of dyslipoproteinaemias and cardiovascular diseases. Identification of LDL subfractions]. Med Milit Slov. 2006; 8: 28-32. Slovak.

9 Oravec S. [Recognition the risk of the heart attack and its prevention]. Der Mediziner. 2010; 4: 6-7. German.

10 Assmann G, Cullen P, Schulte H. Non-LDL related dyslipidaemia and coronary risk: a case-control study. Diab Vasc Dis Res. 2010; 7: 204-212.

11 Appelros P, Nydevik I, Vitanen M. Poor outcome after first-ever stroke within the first year. Stroke. 2003; 34: 122-126.

12 Landray MJ, Edmunds E, Li-saw-hee FL, et al. Abnormal low density lipoprotein subfraction profile in patients with untreated hypertension. QJM. 2002; 95: 165-171.

13 Austin MA, Hokanson JE, Brunzell JD. Characterization of low-density lipoprotein subclasses: methodologic approaches and clinical relevance. Curr Opin Lipidol. 1994; 5: 394-403.

14 Berneis KK, Krauss RM. Metabolic origins and clinical significance of LDL heterogeneity. J Lipid Res. 2002; 43: 1363-1379.

15 Shoji T, Hatsuda S, Tsuchikura S, et al. Small dense low-density lipoprotein cholesterol concentration and carotid atherosclerosis. Atherosclerosis. 2009; 202: 582-588.