Iranian Journal of Neurology

Original Paper

Ir J neurol 2011; 10(1-2): 1- 4

Lipid profile in cerebrovascular accidents

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Received: 10 January 2012
Accepted: 02 March 2012

Keywords
stroke; intracerebral hemorrhage; ischemic stroke; cholesterol; LDL; triglyceride

Abstract

Background: Changes in the lipid profile have been suggested as a risk factor for developing ischemic stroke. Their role in intra-cerebral hemorrhage, however, is not clear. The present study was designed to evaluate the lipid profile levels of patients who had experienced an acute stroke during the first 24-hour and to compare these levels in different patients suffering from the stroke, either hemorrhagic or ischemic, and healthy individuals.

Methods: In this cross-sectional study, 258 consecutive patients with acute stroke admitted to the neurology department of our center during September 2006 and September 2007 were studied. As for the control group, 187 apparently healthy subjects living in the same community and matched for age and sex were selected. Lipid profile was measured and compared between the three groups.

Results: In the patients' group, 65 suffered from hemorrhagic stroke (group 1) and the other 193 had ischemic stroke (group 2). Except for TG values, there was no significant difference among the ischemic and hemorrhagic lipid profile. Age, cholesterol, and LDL influenced the risk of developing an ischemic stroke; TG was not reported as a risk factor or a protective one. While the comparison of data retrieved from patients suffering from hemorrhagic strokes with the controls, revealed LDL as the risk factor contributing to the development of ICH whereas TG was reported as a protective factor.

Conclusion: It could be concluded that LDL level can be considered as a risk factor for both ischemic and hemorrhagic cerebral events

Introduction

Stroke is defined as rapidly developing symptoms and/or signs of focal and global loss of cerebral function lasting for at least 24 hours with no apparent cause other than of vascular origin [1]. Stroke is the cause of one in eight deaths. It also constitutes a dreadful burden of disability for the patients and their relatives. Therefore, effective risk factor intervention represents the most appropriate to reduce stroke morbidity and mortality. While some risk factors such as hypertension and atrial fibrillation have been recognized as independently related to stroke occurrence, the predictive role of lipid profile has not yet been well established, similar to that reported in myocardial infarction [2-5]. Many of the previous clinical investigations have suggested that increased serum cholesterol is a risk factor for ischemic stroke. Its role in Intracerebral hemorrhage (ICH), however, is not clear. Few studies have indicated hypercholesterolemia as a risk factor for ICH [6].

The present study was designed to evaluate the lipid profile levels of patients who had experienced an acute stroke during the first 24-hour and to compare these levels in different patients suffering from the stroke, either hemorrhagic or ischemic, and healthy individuals.

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had ischemic stroke (group 2).

Table 1 outlines the demographic data of the patients enrolled in this study. There were no significant differences between the demographic data of the three groups. The age of the ischemic group was higher than the controls.

The patients' lipid profile in regard with the etiology of the stroke is outlined in table 2. There was no significant difference among the ischemic and hemorrhagic lipid profile, except for the TG values. Findings showed that the control group had the lowest LDL levels. Table 3 demonstrates the relation between the site of hemorrhage/infarction and the measured lipid profile. There was no significant relation between the location of the infarction or hemorrhage and the reported total cholesterol, LDL, TG and HDL levels.

Data showing the influence of different variables on lipid profile is shown in table 4. High levels of LDL increase the risk of hemorrhagic stroke. While the comparison of data retrieved from patients suffering from hemorrhagic strokes with the controls, revealed LDL as the risk factor contributing to the development of ICH, TG was reported as a protective factor. In the ischemic group, age and high levels of LDL are associated with greater risk of developing ischemic stroke. The TG levels, however, did not influence the risk. HDL did not have any considerable impacts in neither of the strokes.

Similar comparison between ischemic stroke and controls showed that any increase in the age and cholesterol was associated with a greater risk of developing the condition (Cholesterol: OR= 1.011, p-value <0.001; age: OR= 1.040, p-value <0.001). On the other hand, comparing hemorrhagic stroke with the control group revealed that cholesterol influences the risk of developing the condition significantly (OR= 1.008, p-value= 0.021), while TG was a protective factor (OR= 0.978,p-value < 0.001).

Materials and Methods

In this cross-sectional study, 258 consecutive patients with acute stroke admitted to the neurology department of Sina hospital affiliated to Tehran University of Medical Sciences during September 2006 and September 2007, were studied.

The main goal was to determine whether hypocholesterolemia is a risk factor for primary ICH. The second goal was to compare the serum cholesterol and Triglyceride (TG) levels in the two types of stroke.

Patients between 40-80 years of age of either sex with clinical findings, brain CT-scan or MRI indicative of cerebral infraction or intra-cerebral hemorrhage were enrolled in this study. The patients with any underlying diseases especially liver disease, familial hypercholesterolemia and hypothyroidism, taking anti lipid and sympathomimetic drugs, and the patients in whom the cerebral hemorrhage was secondary to cerebral tumor, trauma or previous coagulation disorders were excluded from the study.

Lipid profile was measured by collecting the patients' blood after fasting for 9 to 12 hours. The lipid profile of 187 apparently healthy subjects living in the same community was provided for comparison. The subjects were matched for age and sex within the stroke patients and were selected not to have any underlying disease or a positive history of stroke.

Statistical analyses were performed using the SPSS program. Significance of differences between patients and controls and among different stroke subtypes was assessed with t-tests or factorial ANOVA and post-hoc for nominal variables. Logistic regression was used to compare the significance of different factors including the lipid profile of stroke patients and the controls.

Results

Two hundred fifty eight patients and 187 controls were enrolled in this study. In the patients’ group, 65 subjects had suffered from hemorrhagic stroke (group 1) and the other 193

Table 1. Demographic data of the patients enrolled in this study in regard with the stroke subtype

		Control	Group 1 (hemorrhagic)	Group 2 (ischemic)	P-value (control vs. group 1)*	P-value (control vs. group 2)*	P-value (group 1 vs. group 2)*
Age		62.6 ±10.5	65.5 ± 11.2	66.7 ± 10.3	0.108	<0.001	0.713
Gender	Male	96	35	97	0.926	0.968	0.872
	Female	91	30	96			
History of hypothyroidism		0	0	3	-	-	0.318
History of diabetes		0	9	42	-	-	0.183
History of hyperlipidemia		0	10	32	-	-	0.859
History of hypertension		0	41	85	-	-	0.006

Table 2. Lipid profile of the patients enrolled in the study in regard with the stroke's subtype.

	Control	Group 1 (hemorrhagic)	Group 2 (ischemic)	P-value (control vs. group 1)	P-value (control vs. group 2)	P-value (group 1 vs. group 2)
Cholesterol	210.1 ± 38.8	214.7 ± 55.8	226.5 ± 46.1	0.246	<0.001	0.093
TG	168.4± 65.7	117.2 ± 71.1	164.9 ± 86.1	<0.001	0.062	<0.001
HDL	49.1 ± 12.3	48.4 ±14.1	46.8 ± 16.2	<0.001	<0.001	0.577
LDL	124.2 ± 38.3	146.1 ± 57.6	146.8 ± 42.5	<0.001	<0.001	0.927

* * ANOVA

Table 3. Lipid profile of the patients enrolled in the study in regard with the site of stroke in each subtype.

	Site of hemorrhage					Site of infarction		
	thalamus	Basal ganglia	lobar	cerebellar	P-value *	Ant circulation	Post Circulation	P-value *
Frequency (%)	24(24.6)	21 (36.9)	21 (32.3)	4 (6.2)	-	154 (78.6)	42 (21.4)	-
Cholesterol	209.1	203.1	228.3	237	0.384	230.8	210.8	0.434
TG	112.3	106	133.2	123.5	0.663	168.6	150.7	0.625
HDL	43.5	51.8	50.9	34	0.146	48.0	42.3	0.502
LDL	142.9	131.7	154.3	172	0.659	148.0	142.4	0.349

Table 4. The logistic regression showing each variable in each stroke subtype compared with the control group

	Hemorrhagic vs. control			Ischemic vs. control		
	OR	CI 95%	P value	OR	CI 95%	P-value
Age	1.031	0.991-1.073	0.130	1.040	1.021-1.060	0.469
Sex	0.679	0.300-1.536	0.353	0.960	0.665-1.387	0.829
TG	0.967	0.956-0.978	<0.001	0.998	0.989-1.000	0.242
HDL	0.996	0.956-0.978	0.812	1.011	1.006-1.016	<0.001
LDL	1.015	0.963-1.030	0.002	0.005	0.998-1.052	<0.001

Discussion

Stroke makes a considerable contribution to morbidity and mortality and is one of the top four causes of death worldwide. The ICH and ischemic infarction are the main causes of cerebrovascular accidents. There are several reasons and risk factors influencing the risk of developing strokes.

Lipid profile changes are thought to be a risk factor in the occurrence of stroke. On the other hand, stroke itself is also associated with changes in the lipid levels probably because of the accompanying stress and catecholamine overproduction that occurs during an acute stroke. In fact, the available reports have pointed out that stress is associated with considerable decrease in the lipid profile [2].

The present study showed higher levels of total cholesterol in patients with ischemic stroke compared with the control group; it should be noted that there was no significant relations between the site of infarction and the measured level.

Cholesterol can be differently involved in stroke, depending on the etiologic subtype. In this view, a large part of the inconsistency of observational data from large studies on the relation between cholesterol and stroke can be due to gathering data by having both types of stroke together in a same group. This can explain the absence of any detectable association between cholesterol and stroke when all types of the stroke, irrespective of the cause, are considered as outcomes [7]. Indeed, the lack of association might conceal the positive association with ischemic stroke together with a negative association with hemorrhagic stroke, as resulted in this study. The same results were also suggested by some other studies [8-11]. Denti et al reported that LDL-C concentrations over 100 mg/dl along with low HDL-C levels were associated with higher stroke risk [12].

In the present study, we compared the data on the lipid profile of the patients with different types of stroke (hemorrhagic and ischemic) and the control group. Findings revealed a significant relation between lipid profile and the occurrence of the ischemic stroke. LDL was considered as a predictor of hemorrhagic stroke, as well. It also reported that increased cholesterol and LDL levels are associated with higher risk of developing ischemic stroke. TG, however, was not reported to have a considerable role in the development of ischemic stroke. Findings of the present study indicating no role for TG in the ischemic strokes are on the contrary to that of certain previous studies [3,13]; the variable, however, showed a protective effect in patients with ICH.

As non-lipid risk factors, patients showed, as expected, significant differences in the prevalence of diabetes (13.8 vs. 21.4%) and hyperlipidemia (15.4 vs. 16.3%) in hemorrhagic and ischemic strokes. Our study showed that hypertension was significantly associated with group 1 in this study (P= 0.006), in other words a positive history of hypertension was accompanied by 4.5 times higher risk of intra-cerebral hemorrhage in comparison with ischemic infarction. On the other hand, it was revealed that each year increase in age was independently predictive of 4% higher risk of ischemic infarction compared with ICH.

Although we measured lipid profile in acute phase of stroke and ICH and realized lower levels of cholesterol compared with the pre-stroke phase, we did not figured out hypocholesterolemia as a risk factor for intracranial hemorrhage. hemorrhage. Because of possible temporal changes in lipid profile after acute stroke, it would be appropriated to have a 3-month follow up for comparing with the control subjects. In addition, further studies to reveal the level of effect on different types of stroke is recommended.

Conclusion

It could be concluded that LDL levels can be considered as a risk factor for both ischemic and hemorrhagic cerebral events. In view of our study results, total cholesterol was a risk factor in ischemic stroke whereas high TG levels had a protective role against hemorrhagic events. As a result, treating high LDL levels can be a helpful option to reduce these events and eventually decrease the related morbidity and mortality rates. Performing a larger study would be helpful to figure out the definite role of HDL and TG levels in cerebral vascular insults, as well.

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