STUDY OF LIPID PROFILE COMPONENTS IN RELATION WITH TYPE OF STROKE

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ABSTRACT

Strong association has been found between high levels of serum cholesterol, especially of low-density lipoprotein (LDL) cholesterol and the development of atherosclerosis, while elevated levels of high-density lipoprotein (HDL) cholesterol seem to play a protective role. However, evidence linking blood lipids to cerebrovascular diseases has failed to put an end to a long-standing controversy. Studies have shown that the advent of HMCoA reductase inhibitors (Statins), has contributed new evidence supporting association of total cholesterol and LDL levels with risk of Cerebral Ischemia has decreased with no change in risk for hemorrhagic stroke. Objective of this study was to identify different components of lipids in relation to type of stroke, i.e., cerebral ischemia or cerebral haemorrhage.

METHODS

An observational study was conducted to determine differences in serum lipid levels among individuals suffering different types of stroke. Participants included patients in the acute phase of stroke admitted to Victoria Hospital, Bangalore Medical College and Research Institute (BMCRI). Lipid profile was estimated in these patients.

RESULTS

Total of 276 patients with documented stroke were included in the study. Of the 227 total patients, 71.73% (198) were male patients. Lipid components was found to be higher in ischemic stroke compared to hemorrhagic stroke.

STATISTICAL METHODS

Descriptive and inferential statistical analysis has been carried out in the present study.

CONCLUSIONS

High levels of total cholesterol, LDL, and triglycerides were associated with occurrence of atheromatous cerebral infarction, while low levels of total cholesterol and high levels of triglycerides are linked with occurrence of cerebral hemorrhage.

KEYWORDS

Cerebral Ischemia, Stroke, Cerebral Haemorrhage, Lipid Profile.

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INTRODUCTION

Strong association has been found between high levels of serum cholesterol, especially of low-density lipoprotein (LDL) cholesterol and the development of atherosclerosis, while elevated levels of high-density lipoprotein (HDL) cholesterol seem to play a protective role. However, evidence linking blood lipids to cerebrovascular diseases has failed to put an end to a long-standing controversy: Is there a correlation between blood lipid levels and occurrence of stroke?

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A conclusive answer has not been found, since many studies to date have been hampered by conceptual and methodological limitations.

The reason for this is, stroke is being studied as single entity without distinguishing between cerebral infarction and cerebral haemorrhage.

Results change dramatically when ischemic and hemorrhagic strokes are assessed separately. For example, the Multiple Risk Factor Intervention Trial (MRFIT) demonstrated that mortality risk from non-hemorrhagic stroke increased proportionately with serum cholesterol levels in 351,000 men aged 35-57 years. Conversely, negative association was found between hemorrhagic stroke and cholesterol levels below 200 mg/dl: The lower the blood cholesterol level, the greater risk of hemorrhagic stroke.[1] This suggests a U-shaped correlation between blood cholesterol levels and risk of stroke. Combining both types of stroke in a single study, as in the cohort examined for the Prospective Studies Collaboration, masks correlation between blood cholesterol levels and risk of stroke.[2]

The advent of HMCoA reductase inhibitors (Statins), has contributed new evidence supporting association of total cholesterol and LDL levels with risk of Cerebral Ischemia with no modification of risk for hemorrhagic stroke. A meta-analysis of nine clinical trials of statins.[3] showed that these drugs reduced cerebral ischemia risk in patients with a history of Coronary heart disease. Furthermore, the Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL) study found that statins use significantly reduced relapse risk in patients who had suffered cerebral ischemia or a transient ischemic attack.[4] A possible limitation of such trials' ability to demonstrate association between blood lipids and CI is that statins apparently have a favorable effect on atheromatous lesions, unrelated to reduction in total cholesterol and LDL levels.

Objective of this study was to identify different components of lipids in relation to type of stroke, i.e., cerebral ischemia or cerebral haemorrhage.

METHODS

An observational study was conducted to determine differences in serum lipid levels among individuals suffering different types of stroke participants included patients in the acute phase of stroke (Within 24 to 72 hours of onset) admitted to Victoria Hospital, Bangalore Medical College and Research Institute (BMCRI), diagnosis was based on clinical examination and a cranial computed tomography (CT) scan.

Patients presenting to Victoria Hospital casualty with symptoms of stroke were subjected to CT scan to determine the type of stroke and lipid profile [Serum lipid levels: LDL, HDL and total cholesterol (TC); and triglycerides (TG)].
was estimated. All patients were above 55 years of age to avoid other causes of stroke in young. Patients with recurrent stroke, patients on anti-coagulants, statins, anaemia, known lipid metabolic disorder were excluded from study.

The study was approved by the BMCRI Ethics Committee. All potential participants were given the necessary information about the study, and each participant provided written informed consent.

RESULTS

Total of 276 patients with documented stroke attending emergency room of Victoria Hospital were included in the study after they satisfied inclusion criteria. Of the 227 total patients, 71.73%(198) were male patients. Majority i.e., 128 (46.37%) were in age group of 66-75 years as depicted in Table No. 1. of the 276 patients, 125 were hemorrhagic stroke and 151 were infarcts.

201 out of 276 patients i.e., majority were from urban area. Lipid profile analysis showed the following results as shown in Table No. 3., total cholesterol among the hemorrhagic stroke group had majority less than 150 mg/dl i.e., 82 patients out of 125; while in infarct group majority i.e., 112 out of 151 had total cholesterol more than 200 mg/dl. The results were statistically significant with P value of <0.001. Triglycerides analysed in two groups showed majority in hemorrhagic group i.e., 69 had less than 150 mg/dl. While in infarct group majority i.e., 132 had more than 250 mg/dl. It was statistically significant with P=0.0001; 136 out of 151 patients with ischemic stroke had HDL levels in the normal range, whereas patients out of 125 with hemorrhagic stroke had HDL levels in the normal range which was statistically significant with P value of <0.0045 VLDL analysis showed 62 of hemorrhagic stroke between 35-60 mg/dl, while in infarct group 106 patients had more than 60 mg/dl. P value is <0.001. LDL in hemorrhagic group, 81 had less than 70 mg/dl whereas in infarct group 145 had more than 120 mg/dl and P value of 0.0001 was obtained. All the results of lipid profile are depicted in Table No. 3.

Age in Years	Hemorrhagic	Infarct	Total
55-65	51	48	99
66-75	53	75	128
76-85	12	20	32
86-95	9	2	11
Total	**125**	**151**	**276**
Mean±SD	68.60±4.58	71.68±4.56	70.87±4.58

Table 1: Age distribution according to type of stroke in patients studied

Urban/Rural	Hemorrhagic	Infarct	Total
Rural	41	34	75
Urban	84	117	201
Total	**125**	**151**	**276**

Table 2: Urban/Rural distribution in patients studied

P=1.000, Not significant, Fisher Exact test

	Hemorrhagic (n=125)	Infarct (n=151)
Total cholesterol (mg/dl)		
<150	82	7
150-200	38	32
>200	5	112
TGL (mg/dl)		
<150	69	3
150-250	56	16
>250	0	132
HDL (mg/dl)		
<35	39	15
35-60	86	136
>60	0(0%)	0(0%)
VLDL (mg/dl)		
<35	62	19
35-60	51	26
>60	12	106
LDL (mg/dl)		
<70	81	0
70-120	40	6
>120	4	145

Table 3: Lipid Parameters in Two Groups

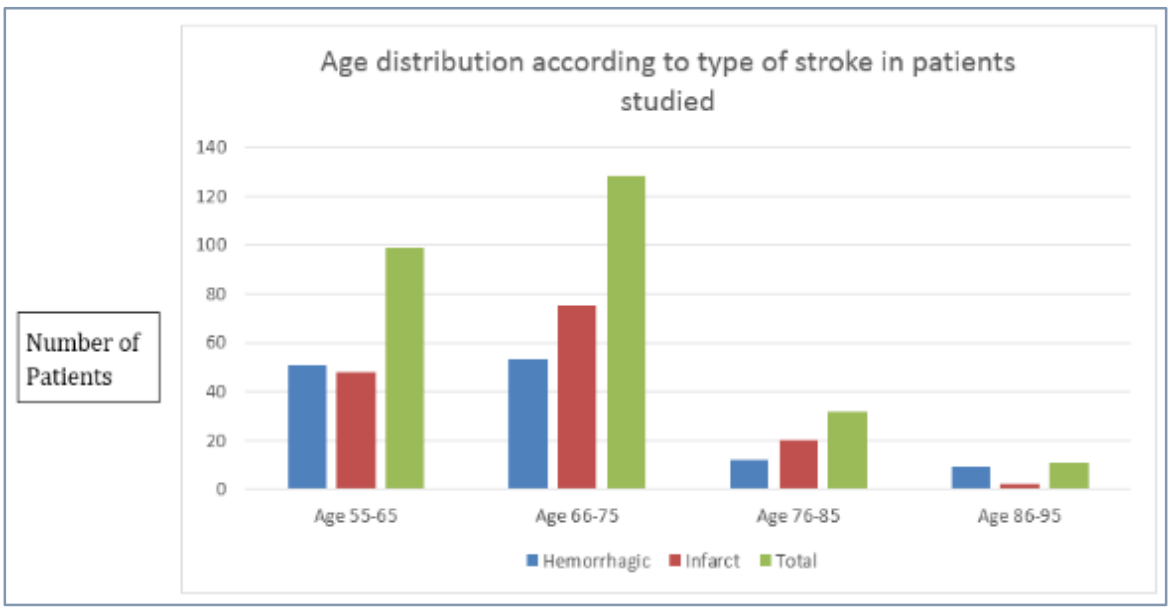

Fig. 1: Age Distribution According to Type of Stroke in Patients Studied

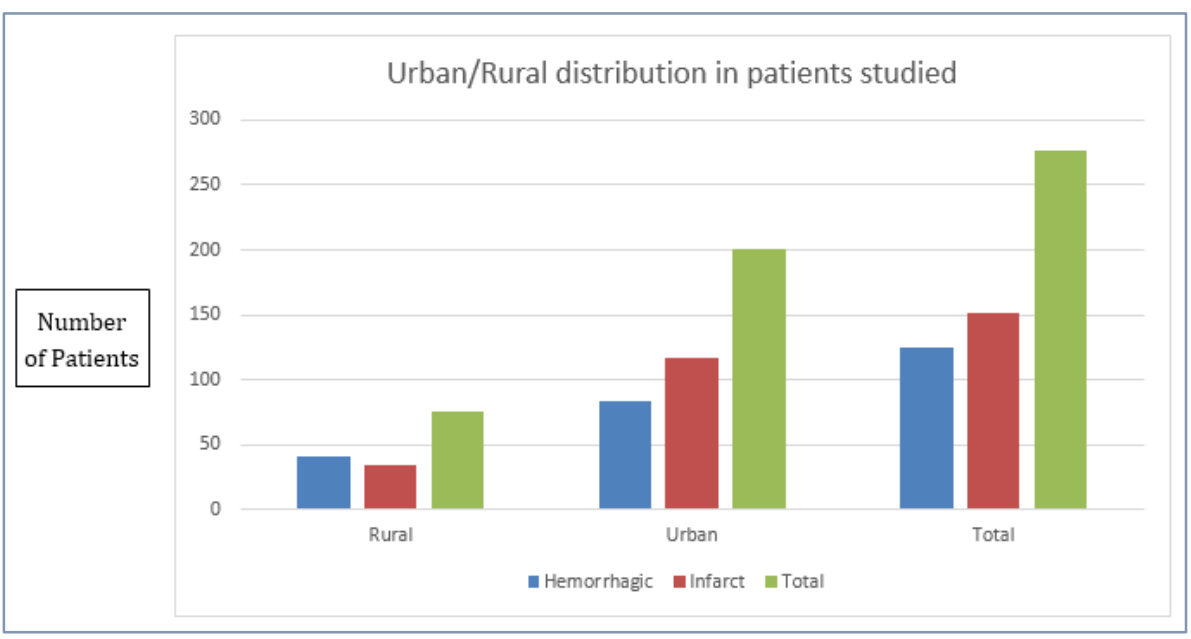

Fig. 2: Urban/Rural Distribution in Patients Studied

STATISTICAL METHODS

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD (Min-Max) and results on categorical measurements are presented in number (%). Significance is assessed at 5% level of significance. The following assumptions on data is made, **Assumptions:** 1. Dependent variables should be normally distributed, 2. Samples drawn from the population should be random, Cases of the samples should be independent.

Student 'T' test (Two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Intergroup analysis) on metric parameters.

Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

Significant Figures:

+ Suggestive significance (P value: 0.05<P<0.10)
* Moderately significant (P value: 0.01<P ≤ 0.05)
** Strongly significant (P value: P≤0.01)

Statistical Software

The statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver. 2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

DISCUSSION

Although our findings indicate that ischemic stroke is associated with lower lipids levels, some studies have found that hypercholesterolemia is a protective factor against CH and that low blood cholesterol increases risk. A five-year prospective study by Okumura et al., in Japan followed 38,053 individuals selected from a mass blood lipids screening carried out in 1983 to assess occurrence of stroke from 1988 to 1991.[5]

This study showed that low levels of blood cholesterol was an independent predictor for Hemorrhagic stroke. Another prospective study by Iribarren et al., of 61,756 individuals enrolled in a health plan in the San Francisco metropolitan area, 30 found an association between low levels of serum cholesterol and CH; however, this study included only men aged >65 years. In a recent article, Amarenco and Steg.[6] reviewed 61 prospective observational studies, and concluded that no association exists between total cholesterol and stroke mortality. These authors acknowledged that stroke is a multifactorial disease and that its various causes are not equally associated with blood cholesterol levels.

They also stated that if a correlation were to exist between cholesterol levels and risk of stroke, it would be with atherothrombotic ischemic stroke. We find an explanation in our study for the lack of association reported by these authors. Dividing the different types and etiologies of stroke has enabled us to demonstrate that patients with ischemic stroke have higher total cholesterol and LDL levels, and lower triglycerides levels than patients with Hemorrhagic stroke. Furthermore, ischemic stroke was characterized by an increase in total cholesterol, LDL, and triglycerides levels. Our results contribute new evidence in the quest for an answer to the long-standing question: Is there an association between blood lipids levels and occurrence of stroke? According to our findings, the answer is that high levels of total cholesterol, LDL, and triglycerides are associated with the occurrence of ischemic stroke, while low levels of total cholesterol and high levels of triglycerides are linked to occurrence of hemorrhagic-stroke.

These preliminary results may shed light on the scientific debate, since they point to the need to stratify cerebral vascular accidents based on their type (Ischemic or hemorrhagic) and on their aetiopathogenesis, in order to determine the real association between lipid alterations and occurrence of these neurological events. For the same reason, this study may also help guide future trials attempting to relate lipid alterations with occurrence of vascular events.

CONCLUSIONS

The type (Ischemic or hemorrhagic) and etiopathogenesis of stroke must be considered when studying the association between its occurrence and blood lipids levels. High levels of total cholesterol, LDL, and triglycerides are associated with occurrence of atheromatous cerebral infarction, while low levels of total cholesterol and high levels of triglycerides are linked with occurrence of cerebral hemorrhage.

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