The Use of Multivariate Analysis in Assessing the Risk Factors of Cerebrovascular Disorders

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Abstract

One hundred and one patients with completed stroke, 50 patients of TIA were compared with 75 age ans sex matched healthy controls for various clinical and biochemical risk factors of stroke. Of the seventeen factors studied eight factors were statistically different amongst the three groups. Using multiple discriminant function analysis it was observed that systotic blood pressure, HDL cholesterol, and sedentary life were the variables influencing the stroke group and higher age at onset, elevated total cholesterol were the variables important in the TIA group.

Key words -
   Stroke,
   Cerebrovascular disease,
   Systolic blood pressure,
   Hypertension,
   Risk factors

The diagnosis and management of stroke is a challenging problem in any neurological centre. Often it leaves the affected subjects with some deficit so much so it leads to emotional and economic handicaps [1], [2]. Several studies have been carried out to evaluate the possible risk factors involved in the etiopathogenesis of stroke which include the Framingham study [3], the Minnesota study [4], studies from Europe and Japan [5], [6]. The WHO carried out a collaborative study during 1971 [7]. In all these studies several risk factors were evaluated and some of them are diet, hypertension, diabetes, alcohol, smoking and consumption of tobacco, blood pressure, cardiac disease and others. The present paper reports observations made during a systematic study of cases of stroke during a period of three years and specially the assessment of risk factors involved in the etiopathogenesis of stroke.

Patients and Methods

One hundred and one patients with completed stroke (neurological deficit lasting for more than 24 hours) and 50 patients with TIA (neurological deficit clearing within 24 hours) seen at the Department of Neurology (both inpatients and outpatients) of NIMHANS constituted the experimental group. Seventy-five age and sex matched healthy subjects formed the control group. Patients with suspicion of intracranial haemorrhage and space occupying lesion were excluded by CT scan. In all the subjects a detailed physical examination was carried out. Socio-demographic data and data relating to the style were collected in a specially designed proforma. Blood samples were collected from all subjects and hematological and biochemical investigations carried out using standard laboratory procedures.

Results and Discussion

The data relating to clinical and laboratory parameters were compared among stroke patients, patients with TIA and control and when analyzed eight parameters were found to be significantly different (Table I). Since the three groups differed amongst themselves on eight of the parameters studied, it was felt that multivariate statistical procedure might throw some additional light in the interpretation of the data. For this purpose multiple discriminant analysis was performed. Multiple discriminant analysis is a powerful statistical procedure in which composite mathematical functions of the variables are constructed to discriminate among the groups. The number of discriminate functions constructed will be equal to one less than the number of groups or number discriminant analysis is a powerful statistical procedure in which composite mathematical functions of the variables are constructed will be equal to one less than the number of groups or number of variables which ever is less. Thus in the present study two discriminate functions could be identified (Table II). The first discriminant function accounted for 88% of the total variation in the data and was statistically significant. In order to know the relative importance of the different variables in discriminant the groups of the coefficients obtained, for the various variables on the two functions were plotted. For this purpose correlation of the various variables with the discriminant functions was computed and multiplied by the respective uni-variate F ratios shown in Table I. Elevated blood pressure (systolic), elevated HDL cholesterol and sedentary occupation were the variables influencing the stroke group. HDL cholesterol is considered to be protective against ischaemic stroke. However, the lipid levels have to be estimated in the absolute fasting state. In the stroke patients who are on Ryle's tube feeds and intravenous alimentation the absolute overnight fasting might not have been strictly followed. Hence, total cholesterol / HDL cholesterol ratio might be more meaningful. The same did not differ statistically between stroke and control, while the ratio was higher (P<0.01) between the TIA and control group (Table III). Higher the age of onset and elevated total cholesterol and LDL cholesterol were the variables influencing the TIA group. The control group was not influenced by any of the variables. The analysis correctly classified 62% of the entire 3 groups, 52% of the stroke group, 67% of the TIA and 75% of the control.

Table I - Significant variables ion patients and controls

Table II - Standardized discriminant function coefficient

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Table III - Ratio of total cholesterol to HDL cholesterol

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Studies from Europe [5], [6], USA [3], [4] and Japan [8], [9] have indicated that the risk for stroke increases with advancing age. Aging is an inevitable process and hence to lessen the risk for the aged, one has to control the factors which are likely to increase the risk of stroke. The Framinghma study [3], the Minnesota study [4] and N. Karelia project from Finland [10] have all pointed out that with control of hypertension and diabetes there is a definite trend in the decline of coronary heart disease and also stroke. The studies from Japan [8], [9] have shown that there is a gradual decline in the incidence of stroke due to the effective management of hypertension and also preventive measures to check the development of hypertension. The studies from Japan have also shown the influence of decreased intake of salt and increased intake of animal fat and protein [8], [9]. The studies on Japanese living in Japan, Hawaii and other parts of USA have also shown variations in the incidence of stroke due to variations in the dietary habits specially when the Japanese change over to the western type of diet [11], [12].

The risk associated with the habits of alcohol, smoking and tobacco as well as glucose intolerance and hypertension (specially systolic) and diabetes have been reported in the Framingham study [3], by Paffenberger and Williams [13] and by Dyken et al [14].

Thus the present study indicates that compared to controls, there was a definite preponderance of stroke in subjects having abnormalities with reference to certain parameters. Many of the risk factors involved in cardiovascular disorders are also noted in cerebrovascular disorders. It may be noted that recognition of risk factors in the former have led to appropriate management measures and also public education programs which have definitely contributed to the decline in the incidence [15]. Such programs also have a potential scope in the prevention of cerebrovascular disorders.

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