

REPORT

RELATION OF SERUM SIALIC ACID WITH SERUM LIPIDS IN CARDIAC PATIENTS

INAYAT-UR-RAHMAN⁺, S.A MALIK* AND WILAYAT AHMAD KHAN**

Institute of Paramedical Technologies, Gandhara Technologies, Gandhara University, Peshawar

**Department of Biological Science, Quaid-i-Azam University, Islamabad*

***Department of Pharmacy, Gomal University, D.I. Khan*

Elevated serum sialic acid concentration is a risk factor for coronary heart disease in general population along with dyslipidemia. Sialic acid and lipid profile was determined in healthy subjects (Group A₁ and A₂) and sixty cardiac patients, divided into two groups, group B comprising of thirty male patients and group C comprising of thirty female patients. A highly significant increase was observed in the level of sialic acid and different variables of lipid profile except HDL-C in all patients. HDL-C showed a significant decrease in patients. An increase in the level of sialic acid in cardiac patients showing the implications of raised level of sialic acid in the development of cardiovascular complications.

Keywords: Sialic acid, lipid profiles, cardiac patients.

INTRODUCTION

Serum sialic acid has been shown to be a cardiovascular risk factor, with elevated levels associated with increased cardiovascular mortality (Lindberg *et al.*, 1991 and 1992). In another study conducted by Wakabayashi *et al* (1992) and Melajarvi *et al* (1996) raised serum sialic acid level was found in groups with high concentration of serum lipids. Sialic acid, a family of acetylated derivatives of neuraminic acid is widely distributed in mammals. It usually occurs as a terminal component at the non-reducing end of carbohydrate chains of glycoproteins and glycolipids (Ng *et al.*, 1976). A variety of biological phenomena are known that can be ascribed to sialic acid. Negatively charged sialic acid residues on cell membranes prevent aggregation of circulating cells by electrostatic repulsion. Sialic acid is involved in the regulation of lifetime of serum glycoproteins and blood cells. Sialic acid is also component of receptors utilized by micro-organisms, toxins and hormones (Schauer R., 1982). In human serum a large quantity of sialic acid is bound to alpha and beta globulins, often referred to as acute phase reactants (Taniuchi *et al.*, 1981) and such substances rapidly increase in concentration after the onset of an inflammatory reaction or injury (Schwick *et al.*, 1986, Crook *et al* 1993a and b).

The evidence of raised level of serum sialic acid as a risk factor for cardiovascular disease and its association with high serum lipids signifies the importance of its status in heart diseases.

Thus the present study was designed to determine the serum

sialic acid level in cardiac patients and to find out its association with serum lipids of such patients.

MATERIALS AND METHODS

This study was carried out on sixty cardiac patients. They were divided into two groups. Group B comprised of thirty male patients and group C comprised of thirty female patients. The same number of apparently healthy individuals of comparable age, sex and socio-economic status served as control. Group A₁ comprised of thirty male and group A₂ comprised of thirty female controls.

Serum sialic acid was determined by the method described by Natelson (1961), according to which trichloroacetic acid filtrate of serum was treated with sulfuric acetic acid reagent sialic acid or closely related substances react with sulfuric acetic acid reagent to form pink color. The intensity of color is directly proportional to the concentration of sialic acid and is read in a spectrophotometer at 530 nm, serum lipids by Trinder method, clonital kit. The analytical precision of each method was checked against the standards provided with the kits. Data were expressed as mean $\pm$ SEM and the statistical significance was calculated by applying student's "t" test. Relationship between variables was determined by calculating coefficient of correlation.

RESULTS

Mean age (+SEM) of the two experimental groups of patients did not differ significantly from that of control

⁺Correspondence: Inayat-ur-Rehman, Principal, Institute of Paramedical Technologies, Gandhara University, Peshawar.
Tel: 091-844429-32

Table 1
Age and BMI of control subjects and patients

Subjects/Groups	Age	BMI
Group A ₁ (30)	50.53 ± 1.04	21.93 ± 0.51
Group A ₂ (30)	51.63 ± 0.95	22.13 ± 0.54
Group B (30)	51.23 ± 0.65	22.06 ± 0.45
Group C (30)	52.33 ± 0.91	22.83 ± 0.39

Values are expressed as mean ± SEM

Table 2
Serum sialic acid, total cholesterol, triglyceride, high density lipoprotein cholesterol and low density lipoprotein cholesterol levels of normal control subjects and patient's groups

Subjects/Groups	Sialic acid mg/dl	TC mg/dl	TG mg/dl	HDL-C mg/dl	LDL-C mg/dl
Group A ₁ (30)	44.46 ± 1.09	190.66 ± 0.98	119.8 ± 0.98	43.33 ± 0.69	107.36 ± 2.08
Group A ₂ (30)	45.3 ± 1.06	194.2 ± 0.53	113.6 ± 1	47.96 ± 0.81	109.56 ± 2.20
Group B (30)	62.23 ± 0.96 ^{◇◇}	232.10 ± 2.59 ^{◇◇}	212.7 ± 1.18 ^{◇◇*}	34.86 ± 0.54 [◇]	158.9 ± 3.36 ^{◇◇}
Group C (30)	62.09 ± 0.78 ^{**}	246.6 ± 2.48 ^{**}	205.26 ± 1.04 ^{**}	37.66 ± 0.53 [*]	161 ± 3.1 ^{**}

Values are expressed as mean ± SEM

◇ Control Group A₁ vs Group B

◇/♣/*

P < 0.05 Significant

♣ Control Group A₂ vs Group C

◇◇/♣♣/**

P < 0.01 Highly significant

* Group B vs Group C

subjects as all groups were selected between the age of 30-60 years. BMI of both the patient's groups showed no significant change in comparison with normal control subjects. Serum sialic acid, serum total cholesterol, LDL-cholesterol and triglyceride levels were significantly high ($P < 0.01$) in both the patient's groups as compared to control subjects. HDL cholesterol level was low in both the patient's groups as compared to control subjects. The decrease was significant (< 0.05) in both the patient's groups.

Correlation coefficient was determined between sialic acid and variables of lipid profile. Group A₁ and A₂ both revealed a positive correlation between sialic acid and TC, LDL-C and TG. Patients of group B showed a significant positive correlation of sialic acid with TC ($r = +0.4$), LDL-C ($r = +0.3$) and TG ($r = +0.26$). Patients of group C also revealed a significant positive correlation of sialic acid with TC ($r = +0.35$), LDL-C ($r = +0.31$) and TG ($r = +0.2$). However the relation of sialic acid with HDL-C showed a negative trend.

DISCUSSION

This study shows a highly significant rise in serum sialic acid, TC, LDL-C and TG of cardiac patients as compared to normal control subjects. A highly significant rise of values

of patient's groups as compared to control subjects may be due to the fact that in our study most of the patients were recovering from a recent attack of myocardial infarction. The HDL-C levels were low in both the patient's groups as compared to control subjects. HDL-C is the fraction responsible for removal of cholesterol from circulation. These results are in agreement with the reports of Wakabayashi *et al* (1992) and Melajavi *et al* (1996) who reported significantly positive correlation between serum sialic acid and serum lipids. Sialic acid level in blood rises along with age and in acute myocardial infarction (Crook *et al.*, 1994). It is a constituent of cell membrane and is present in most acute phase proteins. A recent prospective study carried out by Kario and Matsuo (1993) showed that mortality due to cardiovascular disease was increased in people with high serum sialic acid concentration and may reflect the existence or activity of atherosclerosis.

The correlation between serum TC, LDL-C and TG with serum sialic acid is reestablished in the present study and revealed a significant positive correlation of sialic acid with TC, LDL-C and TG and a negative correlation with HDL-C upholding the views of Lindberg *et al* (1992), Crook *et al* (1992) and Yokohama *et al* (1995). Lindberg *et al* (1993) have reported that rising level of sialic acid is a strong predictor of coronary artery disease.

Results of the present study suggest that the serum concentration of sialic acid is affected by serum lipids and is increased in cardiac patients. Thus individuals with dyslipidemia and high sialic acid level need to be more careful to avoid further complications.

REFERENCES

- Crook MA and Tutt P (1992). Serum sialic acid concentration in patients with hypertriglyceridemia showing the Frederick sons type 2 b phenotype. *Clin. Sc.*, **83**: 593-595.
- Crook MA, Haq M, Haq S and Tutt P (1993a). Serum sialic acid and lipid associated sialic acid in normal individuals and patients with myocardial infarction, and their relationship to acute phase proteins. *Ann. Clin. Biochem.*, **30**: 383-386.
- Crook MA, Tutt P, Simpson H and Pickup JC (1993b). Serum sialic acid and acute phase proteins in type 1 and type 2 diabetes mellitus. *Clinical Chemica. Acta.*, **219**: 131-138.
- Crook MA, Haq M, Haq S and Tutt P (1994). Plasma sialic acid and acute phase proteins in patients with myocardial infarction. *Angiology*, **45**(8): 709-715.
- Kario K and Matsuo T (1993). Relation between sialic acid concentration and haemostatic system in elderly. *BMJ.*, **306**: 1650-1651.
- Lindberg G, Eklund G, Gluberg B and Rastam L (1991). Serum sialic acid concentration and caerdivasular mortality. *BMJ.*, **302**: 143-146.
- Lindberg G, Eklund G, Gulberg B and Rastam L (1992). Serum sialic acid concentration predicts coronary artery disease and stroke mortality: multivariate analysis including 54285 men and women during 30.5 years follow up. *Int. J. Epidemiol.*, **21**: 253-257.
- Lindberg G Eklund G, Gulberg B, Rastam L, Lumblad A, Ehie PN and Hansen BS (1993). Serum concentration of sialic acid and sialoglycoproteins in relation to coronary heart disease risk markers. *Atherosclerosis*, **103**: 123-129.
- Melajarvi N, Gulling H and Metteinien TA (1996). Sialic acid and the metabolism of LDL. *J. Lipid Res.*, **37**(8): 1625-1631.
- Natelson S (1961). Micro Techniques of chemical chemistry for the routine laboratory-2nd ed. Spring field Thomas, pp.378-80.
- Ng S and Dain JA (1976). The natural occurrence of sialic acids. In: Rosenberg A, Schengrund S, eds. Biological roles of sialic acid. New York, Plenum, pp.59-102.
- Pick up JC, Mattock MB, Crook MA, Chusmey GD, Burt D and Fitzgerald AP (1995). Serum sialic acid concentration and coronary heart disease in NIDDM. *Diabetes Care*, **18**(8): 1100-1103.
- Schauer R (1982). Chemistry, metabolism and biological functions of sialic acids. *Adv. Carbohydrchem. Biochem.*, **27**: 91-102.
- Schwick HG and Haupt H (1986). Properties of acute phase proteins of human plasma. *Behring. Inst. Mitt.*, **80**: 1-10.
- Taniuchi K, Chifu K and Hayashi N *et al* (1981). Method for the determination of sialic acid in serum and its applications for a marker of acute phase reactants. *Kobe. J. Med. Sci.*, **27**: 91-102.
- Wakabyashi I, Sakameto K, Yoshimoto S and Misui S (1992). Relation of sialic acid to lipid concentration. *BMJ*, **305**: 562-563.
- Yokohama H, Jenson JS, Jenson T and Deckert T (1995). Serum sialic acid concentration is elevated in IDDM, especially in early diabetic nephropathy. *J. Int. Med.*, **237**: 195-123.