ORIGINAL RESEARCH

Evaluation of Serum Lipid Profile in Oral Cancer Patients: A Case–control Study

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ABSTRACT

Aim and Objectives: Evaluation of serum lipid profile in oral cancer patients.

Materials and Methods: The study included volunteers attending the OPD of Oral Medicine and Radiology (Pacific Dental College and Hospital and Geetanjali Medical College and Hospital), Udaipur. The control group consisted of 23 healthy individuals, 14 males and 9 females, with the mean age of 45 years.

Results: Highly significant ($P < 0.01$) lower levels of mean serum TC, LDL, VLDL, and TG were found in oral cancer patients as compared with control subjects.

Conclusions: The result of the present study shows the evidence of an inverse relationship between serum lipid profile and oral cancer.

Keywords: Cholesterol, Oral cancer, Serum lipid profile.

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INTRODUCTION

Head and neck cancer is one of the leading causes of morbidity and mortality due to cancer. Its incidence is much higher in Asian countries, as compared to the west. Approximately 90% of people with oral cancer are tobacco users. All forms of tobacco such as cigarettes, pipes, cigars, and smokeless tobacco have been implicated in the development of oral cancer. It is believed that tobacco carcinogens induce the generation of free radicals and reactive oxygen species, which are responsible for high rate of oxidation/peroxidation of polyunsaturated fatty acids. This peroxidation further releases peroxide radicals. This affects essential constituents of the cell membrane and might be involved in carcinogenesis/tumorigenesis. Due to the lipid peroxidation, there is a greater utilization of lipids including total cholesterol (TC), lipoproteins, and triglycerides (TGs) for new membrane biogenesis. Cells fulfill these requirements either from circulation, by synthesis through the metabolism or from degradation of major lipoprotein fractions such as very low-density lipoprotein (VLDL), low-density lipoprotein (LDL), or high-density lipoprotein (HDL). Four major groups of lipoproteins are recognized: (1) VLDL: Transport triglycerol from the liver, (2) chylomicrons: Which transport lipids resulting from digestion and absorption, (3) LDL: Deliver cholesterol to the tissue, and (4) HDL: Remove cholesterol from the tissue and return to liver for excretion.[1] Lower blood lipids have been associated with various cancers. Furthermore, some investigators have also found relation of lower serum cholesterol with increased risk of cancer and mortality.[2]

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MATERIALS AND METHODS

The study included volunteers attending the OPD of Oral Medicine and Radiology (Pacific Dental College and Hospital and Geetanjali Medical College and Hospital), Udaipur. The control group consisted of 23 healthy individuals, 14 males and 9 females, with the mean age of 45 years. The study group consisted of 23 patients, 21 males and 2 females, with the mean age of 46 years. All the cases included in the study group had histopathologically proven squamous cell carcinoma of oral cavity. After taking thorough case history and prior informed consent were obtained for further evaluation. Blood sample was collected from the study and control group for estimating fasting lipid profile.

Statistical Analysis

Tabulation of results was carried out for the oral cancer and control group. All the variables from the study were statistically analyzed for the mean values, standard deviation, standard error range, and *P* value. Evaluation of results and statistical analysis was carried out using Student's *t*-test. In all the above tests, $P = 0.05$ was taken to be statistically significant and $P < 0.01$ was taken to be statistically highly significant.

RESULTS AND OBSERVATIONS

The serum lipid profile in the form of TC, HDL, LDL, VLDL, and TG was estimated in each and every subject in this study. The mean serum lipid profile values of oral cancer and control groups are shown in Table 1. Highly significant ($P < 0.01$) lower levels of mean serum TC, LDL, VLDL, and TG were found in oral cancer patients as compared with control subjects [Table 2].

DISCUSSION

Cholesterol is an amphipathic lipid and, as such, is an essential structural component of all cell membranes and the outer layer of plasma lipoproteins. It is present in tissues and plasma lipoprotein either as free cholesterol or combined with a long-chain fatty acid, as cholesteryl ester. It is synthesized in many tissues from acetyl-coenzyme A and is ultimately eliminated from the body in the bile as cholesterol or bile salts.[1] Cholesterol is an important constituent of plasma membrane and plasma lipoproteins, particularly the nervous tissue. It is parent compound of all steroids synthesized in body.[3,4] Although cholesterol excess is linked with coronary diseases, its deficiency is debated as a cause of death in other diseases, especially cancer. Pre-treatment plasma cholesterol was found to be significantly lower in cancer patient, and significant increases occurred with treatment and of death occurred when its level was lower than half the initial level. Incidence cancer had significantly lower mean serum cholesterol levels at intake than non-cancer population.[5,6] Lipoprotein transports free cholesterol in the circulation, where it readily equilibrates cholesterol in other lipoproteins and in membranes. Lipoproteins are clusters of proteins and lipids, all tangled up together to carry lipids in our blood. Lipids are high-energy yielding molecules and include fats and oils, waxes, phospholipids, steroids, and some other related compounds. Fats and oils are made from two kinds of molecules: One glycerol and three fatty acids joined by dehydration synthesis, known as TGs, which are the major form of energy storage. For transport in plasma, TGs and cholesterol are packaged into lipoproteins, which are then taken up as degraded by cells to fulfill the demands for cellular functions. Lipids are major cell membrane components essential for various biological functions including cell growth and division of normal and malignant tissues, maintenance of the structural and functional integrity of all biological membranes, activity of membrane-bound enzymes, and stabilization of DNA helix. There are two main categories of lipoproteins: High-density lipoprotein (HDL) being associated with carrying "cholesterol" out of the blood system and low-density lipoprotein (LDL) which transports 75% of plasma cholesterol. Cell receptors metabolize circulating LDL and clear nearly 80% of it from the body, while the rest of it is associated with

Table 1: The distribution of mean and standard deviation of serum lipid profile levels in oral cancer and control groups

Serum fasting lipid profile	Groups	*n*	Mean	Std. deviation	Std. error mean
Total cholesterol	Oral cancer	23	172.177	8.9465	1.9074
	Control group	23	209.465	12.9427	2.6987
Serum triglyceride	Oral cancer	23	102.900	17.0961	3.6449
	Control group	23	127.183	17.1885	3.5840
High-density lipid	Oral cancer	23	39.727	1.8617	0.3969
	Control group	23	39.913	3.6316	0.7572
Low-density lipid	Oral cancer	23	111.764	7.3982	1.5773
	Control group	23	143.800	11.0717	2.3086
Very low-density lipid	Oral cancer	23	20.570	3.4300	0.7313
	Control group	23	25.500	3.3192	0.6921

Table 2: Statistical *P* value comparison between different serum lipid profile levels

Serum fasting lipid profile	Mean difference	Std. error difference	*t*	Df	*P*
Total cholesterol	−37.2879	3.3314	−11.193	43	0.000
Serum triglyceride	−24.2826	5.1124	−4.750	43	0.000
High-density lipid	−0.1858	0.8664	−0.214	43	0.831
Low-density lipid	−32.0364	2.8204	−11.359	43	0.000
Very low-density lipid	−4.9300	1.0061	−4.900	43	0.000

deposition of "cholesterol" on the walls of arteries.[3] Patel *et al.*,[2] in 2004, Lohe *et al.*,[7] in 2009, and Chawda *et al.*,[4] in 2011, observed in their study that there is a significant decrease in TC, HDL, VLDL, and TG in oral cancer patients.The results and observations of the serum lipid profile assay in the present study showed that there was significant decrease in TC, LDL, VLDL, and TG in oral cancer groups as compared to control group. HDL did not reveal any significant difference as compared to control.

LDL most clearly reflects the decrease in TC. The role of HDL and TGs in explaining the overall pattern of TC change is less clear. Regulation of cholesterol is mediated by lipoprotein receptors. Plasma TGs and cholesterol are packed into lipoproteins for transport. Cholesterol is an essential constituent of lipoprotein fractions such as LDL, HDL, and VLDL. 75% of the plasma cholesterol is transported in the form of LDL. LDL receptors are necessary for metabolizing circulating LDL levels and nearly 80% of the plasma LDL is cleared by LDL receptors. High activity of LDL receptors attributes for lowering the serum cholesterol levels. High TC levels are a risk factor for ischemic heart disease, and it was suggested desirable to keep TC levels as low as possible. However, when examining all-cause mortalities, high mortality is observed not only in cases with high TC levels but also with low TC levels.[8-10] A high prevalence of malignant disease in the low TC population has attracted attention. Four explanation for this phenomenon may be proposed: (1) A coincidental result, (2) presence of other causal factors that simultaneously decrease TC levels and increase cancer risk, (3) hypocholesterolemia induces an increase in cancer, and (4) hypocholesterolemia is a result of the pathological effect of cancer.[11] The possibility that people died at an early age from coronary heart disease than from cancer, thereby depressing the mortality from cancer most in the highest fifth and least in the lowest fifth of cholesterol distribution may be discounted because the average age at death from cancer and from coronary heart disease was similar throughout the range of plasma cholesterol values.[12,13] More controversial than the positive relation between cholesterol concentration and coronary heart disease is the inverse association of cholesterol with cancer.[14] The individuals having deficient or defective LDL receptors remove plasma LDL at much lower rate and have considerably elevated levels. In some malignancies, serum cholesterol undergoes early and significant changes. Low levels of cholesterol in the proliferating tissues and in blood compartments could be due to the rapidly dividing cells in malignancies. A true lack of association between cholesterol and cancer would be observed as an inverse relation only if the risk for coronary death was substantially higher among those more susceptible to cancer (by reason of environmental exposure and/or genetic factors) than among those less susceptible to cancer.[13]

In the oral malignancy, serum cholesterol undergoes early and significant changes. Low level of cholesterol in the proliferating tissue and in the blood compartment could be due to rapidly dividing cells in the oral malignancy.[4] There appear to be three main competing hypotheses to explain the inverse association between cholesterol concentrations and the incidence of cancer. First, lower cholesterol values, even before the manifestation or detection of cancer; second, lower cholesterol values may precede the development of cancer, but the association with cancer is secondary, that is, cholesterol serves as a marker for some other causal variable or set of variables; and third, lower cholesterol values may precede the development of cancer; therefore, the changes in lipid levels may have a diagnostic role in the early detection of oral cancer.[7,8] It is evident that in oral lichen planus and leukoplakia there is significantly higher serum cholesterol, lower serum HDL cholesterol, and lower serum TGs value, whereas in oral submucous fibrosis, there is significantly lower serum cholesterol, lower serum HDL cholesterol, and lower serum TG.[3] The changes in lipid levels may have a diagnostic or prognostic role in early diagnosis and prognostication of oral premalignant and malignant lesions.[13]

Few studies observe that the association between low serum cholesterol and cancer was confined to men in whom a diagnosis of cancer was made within 2 years after the date of blood collection suggest that the low serum cholesterol is a metabolic consequence than a precursor of the cancer.[12] Hence, the low serum lipid profile is an additional predictor of cancer.

One of the earliest suggestions that diet may play a role in the etiology of oral cancer comes. There is also consistent evidence that consuming drinks and foods at a very high temperature increase the risk for oral cancers. Incidence rates for oral cancer in India are among the highest in the world. Most are associated with diet, weight, and other lifestyle factors. Betel quid contains a variety of ingredients such as lime, catechu, and areca nut and is often mixed with tobacco. A case–control study in Southern India investigated the influence of pan, body mass index (BMI), diet, infections, and sexual practices on oral cancer. BMI was inversely associated with oral cancer, and pan chewers with low BMI had a very high risk of developing oral cancer. Frequent consumption of fish, eggs, a variety of raw and cooked vegetables, and fruit was associated with a decreased risk of oral cancer.[14,15] Fruits and vegetables share some nutrients

of suspected importance in cancer etiology, especially Vitamin C, fiber, and beta-carotene. Numerous dietary and nutritional factors have been studied with respect to oral cancer. These are broad food groups, vitamins (especially A, C, and beta-carotene), specific food items, and other nutrients such as zinc and alcohol intake. Few studies in India showed that those who did not eat vegetables daily had twice the risk of oral cancer as those with daily consumption.[9]5-Overall, a high intake of fruits and vegetables probably reduces the risks of cancers of the oral cavity.

CONCLUSION

The result of the present study shows the evidence of an inverse relationship between serum lipid profile and oral cancer. It appears that the lower serum lipid status may be considered as a useful indicator for initial changes occurring in the neoplastic cells. Furthermore, the mean serum lipid profile level between histological grading of the oral cancer had no statistical significance. From the finding of this study, it appears that serum lipid profile used as a biochemical indicator for initial changes occurring in neoplastic cells.

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