LIPID PEROXIDATION AND LIPID PROFILE IN PATIENTS WITH SENILE CATARACT

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ABSTRACT: Lipid peroxidation products and biochemical parameters like fasting blood sugar and lipid profile were estimated in serum of 40 senile cataract cases (45-60 years) and 40 persons of age and sex matched healthy controls. Plasma Thiobarbituric acid reactive substances (TBARS) levels [as Malondialdehyde (MDA)] were significantly higher in patients with senile cataract (573±64.4nmol/dl, P<0.001) as compared to healthy controls (378±31.31 nmol/dl). Serum cholesterol, Triglycerides, LDLC, VLDLC levels were increased as compared to controls. But HDLC levels were decreased in senile cataract patients as compared to controls. No significant change was observed in FBS values. The present study shows that the oxidative stress may play an important role in the senile cataract.

KEYWORDS: Lipid Peroxidation, Malondialdehyde, Lipid Profile and Senile Cataract.

HOW TO CITE THIS ARTICLE: Satya Devi Uppu, Madhur M. Gupta. "Lipid Peroxidation and Lipid Profile in Patients with Senile Cataract". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 93, November 19; Page: 15850-15852, DOI: 10.14260/jemds/2015/2299.

INTRODUCTION: Cataract formation represent a serious problem in the elderly people with approximately 25% of the population aged above 65yrs and about 50% aged above 80yrs experiencing a serious loss of vision as a result of this condition. In India, according to a recent survey by the Rapid Assessment of Avoidable Blindness (RAAB) cataract is responsible for 77.5% of avoidable blindness.[1] Cataract is a complete or partial opacification of sufficient severity on or in the human lens or capsule to impair vision. Lipid peroxidation is a chain reaction providing a continuous supply of free radicals that initiate further peroxidation.[2] The deleterious effects are considered to be caused by free radicals (ROO, RO, OH) produced during peroxide formation from fatty acids containing methylene interrupted double bonds, i.e, those found in the naturally occurring poly unsaturated fatty acids.

The process of lipid peroxidation affects the permeability of cell membrane, the metabolism of membrane lipids and proteins, provides control of cell proliferation, but the adverse effects of this process occurring under conditions of oxidative stress, i.e. in conditions of impaired balance of pro oxidation and antioxidation factors of the cell. Lipid peroxidation is considered as a pathogenetic factor of cataractogenesis.[3,4,5,6,7] Lipid peroxidation in the lens may be induced by endogenous or exogenous factors like enzymes, Reactive oxygen species, metal ions, ultra violet irradiation, heat, radical initiating chemicals, drugs etc.

The role of lipid peroxidation in the development of cataract has been identified. Initial stages of cataract are characterized by the accumulation of primary diene conjugate.

Financial or Other, Competing Interest: None.
Submission 29-10-2015, Peer Review 30-10-2015,
Acceptance 09-11-2015, Published 18-11-2015.
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DOI:10.14260/jemds/2015/2299.

Lipid peroxidation has been investigated as one of the possible mechanisms of cataractogenesis in the human. Malondialdehyde (MDA), a major breakdown product of lipid peroxides, was significantly higher in cataractous lenses as compared to that in normal lenses.[8] Keeping this in view, the biochemical parameters (fasting blood sugar, total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol, VLDL cholesterol and oxidative stress (MDA) in the venous blood of cataract patients vis-à-vis healthy controls was studied.

MATERIALS AND METHODS: A case control study was conducted in the Department of Biochemistry, Rangaraya Medical College, Kakinada, N.T.R. University of Health Sciences, Andhra Pradesh to determine the changes in lipid peroxidation and biochemical parameters in venous blood of diagnosed cases of senile cataract patients attending as the outdoor patients in the department of ophthalmology. Study group includes 40 diagnosed senile cataract cases in the age group of 45-60 years, and 40 persons of age and sex matched normal healthy persons.

Patients with ocular surgery, inflammation, infection of the eye, diabetes mellitus, hypertension and steroidtherapy are excluded from the study. The study was approved by the Institutional Research Ethics Committee. Informed consent was obtained from all 80 subjects. 8ml of venous blood samples were collected in EDTA bottles, plain bulbs and fluoride tubes from patients with cataract and healthy controls. Blood samples were centrifuged at 3000 rpm for 10 minutes.

The standard protocols were followed for estimation of biochemical parameters *viz.,* fasting blood sugar by GOD-POD method, total cholesterol by CHOD-PAP method, triglycerides by GPO-PAP method, HDL cholesterol by Phospho tungstic acid method, LDL cholesterol, VLDL cholesterol were calculated by Fried-wield's formula and MDA by Thiobarbituric Acid (TBA) Reaction method and these parameters were determined by using spectrophotometer.

STATISTICAL ANALYSIS: The observed values were compared with control group for statistical analysis.

All data were expressed as Mean ± standard deviation. Student 't' test paired two sample for means was used to compare the values. Differences with a 'p' value of less than 0.05 were considered to be statistically significant.

RESULTS AND DISCUSSION: It can be deduced from Table 1 that the mean plasma levels of Glucose were high in the venous blood of senile cataract cases (105.53±46.25) as compared to control group (102.85±8.22). Similarly the mean levels of total cholesterol and Triglycerides were high in senile cataract cases (Total cholesterol 186.38±43.4, Triglycerides 207.95±13.98) as compared to control group (Total cholesterol 146.2±11.27, Triglycerides 146.13±12.67). Contrarily the mean levels of HDL cholesterol were high in control group (39.8±4.73) than in senile cataract cases The mean levels of LDL and VLDL cholesterol were higher in senile cataract cases (LDL:126.3±42, VLDL: 41.45±2.91) as compared to control group (LDL: 76.53±12.81, VLDL: (21.22±2.63) The mean levels of LDL and VLDL cholesterol were higher in senile cataract cases (LDL: 126.3±42, VLDL: 41.45±2.91) 29.48±2.98). The mean levels of MDA were also high in senile cataract cases (573±64.3) as compared to control group (378±31.31).

Statistical analysis ('t' test: paired two sample for means) of different biochemical parameters viz., plasma glucose, total cholesterol, Triglycerides HDL cholesterol, LDL cholesterol, VLDL cholesterol and MDA in venous blood of senile cataract cases and control group showed that the't' values of total cholesterol (5.56) Triglycerides (26.97), LDL cholesterol (7.32), VLDL cholesterol (22.13) and MDA (16.83) were significant 'p' level of <0.05. However, the't' values of plasma glucose (0.35) and HDL cholesterol (-23.58) were statistically non-significant (Table 1). It can be deduced from Table 2 that correlation of MDA with lipid profile in cataract cases showed that there is a significant negative correlation between MDA and HDLC (r^2=-0.373 at 5% level). The correlation of MDA with LDLC was positive but not significant.

Parameter	Cataract (n=40)	Control (n=40)	't' value	'P' value
Plasma Glucose in mg%	105.53±46.25	102.85±8.22	0.35	NS
Total cholesterol in mg%	186.38±43.40	146.2±11.27	5.56	<0.001 S
Triglycerides in mg%	207.95±13.98	146.13±12.67	26.97	<0.001 S
HDL cholesterol in mg%	21.22±2.63	39.8±4.73	-23.58	NS
LDL cholesterol in mg%	126.3±42.00	76.53±12.81	7.32	<0.001 S
VLDL cholesterol in mg%	41.45±2.91	29.48±2.98	22.13	<0.001 S
MDA in nmol/dl	573±64.30	378±31.31	16.83	<0.001 S

Table 1: Levels of Different Biochemical Parameters and MDA in Venous Blood of Senile Cataract Cases and Control Group

n= number of cases or control groups, All values are expressed in Mean ±SD NS=Non-Significant; S=Significant

Parameter	Correlation Coefficient
1. HDLC	-0.373*
2. LDLC	0.060
3. VLDLC	-0.057
4. Triglycerides	-0.065
5. Cholesterol	0.032

Table 2: Correlation of MDA with lipid profile in cataract cases – correlation coefficient (r^2)

* Significant at 5% level

DISCUSSION: Oxidative stress is a term used to describe any challenge in which pro-oxidants predominate over antioxidants[9]. It may be due to either increased production of reactive oxygen species (ROS) or decreased levels of antioxidants (Enzymatic and Non enzymatic) or both. Oxidative stress is thought to play a crucial role in the development of age related cataract. Quantitation of malondialdehyde is one of the sensitive and simple means of measurement of lipid peroxidation.

It is also important as MDA has been implicated in cytotoxicity and in pathogenesis of metabolic disorder.[10] In our study MDA is the indicator of lipid peroxidation, which is significantly elevated (P<0.001) when compared with controls suggesting that increased MDA and lipid peroxidation may be considered as indicators of senile cataract formation. Similar observations also made by Babizhayer MA et al.[11] Donma et al.[4] Renu Garg et al.[12] Indranil chakraborthy et al.[13] Zehra Hashim and Shanshad Zarina.[14]

The lipid peroxides are responsible for the formation of cataract and also cataract causes increased lipid peroxidation levels, thus the development of a vicious cycle involving cataract, cell damage, and lipid peroxides is involved in the pathology of the lens. Increased MDA levels shows that increased peroxidation of unsaturated fatty acids in the lipid bilayers of lenticular plasma membrane. The peroxidative damage to the lens is one of the major events in pathogenesis of cataract.

This might be mediated by toxic metabolites of oxygen such as superoxide anion radical, hydrogen peroxide and hydroxyl radicals as a consequence of the impaired enzymatic defences against their toxicity. In our study FBS values were high in venous blood of senile cataract cases as compared to control group. In a population based longitudinal study by Tan et al.[15] patients with baseline impaired fasting glucose (IFG) had an increased risk of developing cortical cataract.

They stated that increasing serum glucose was related to a higher risk of incident cortical cataract.

Hyperglycaemia is accompanied by elevated levels of superoxide ions due to glucose oxidation. Interaction of glucose with proteins leading to the formation of advanced glycation end products (AGES). Glycation not only promotes generation of free radicals but can also alter the structure and function of antioxidant enzymes rendering them unable to detoxify free radicals. In the present study, the serum cholesterol, triglycerides, LDLC, VLDLC levels were significantly increased ($p<0.001$) when compared to controls.

HDLC values are significantly decreased in cataract compared to controls. Several recent studies have examined the relationship between selected serum lipids and lipoproteins and the occurance of cataract. Meyer et al.[16] indicated the strong association between low levels of HDLC and high LDL: HDL ratio on one hand and the development of cataract on the other. Senile cataract often accompanied by hyper cholesterolemia, hyper triglyceridemia and low HDLC levels and the incidence of arteriosclerosis is higher in cataract patients than in control group. It is possible that hyper lipidemia which is a known risk factor for senile cataract. LDLC is positively correlated but not significant.

CONCLUSION: Although aging itself can play a role in generating oxidative stress, our results clearly indicate oxidative imbalance is more pronounced and hyperlipidemia is a causative factor of senile cataract. Further studies should be conducted to elucidate the molecular mechanisms by which antioxidants modulate their protective role, in order to identify potential pathways and more importantly, new protective factor.

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