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Oxidative stress and Antioxidant level in the serum of osteoarthritis patients

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Abstract- WHO estimates that osteoarthritis (OA) affects 9.6% of men and 18% of women older than 60 years of age. Increases in life expectancy and ageing populations are expected to make OA the fourth leading cause of disability by the year 2020. Oxidative stresses are believed to function as primary degenerative mechanism in the development and progression of osteoarthritis. The exact oxidant and antioxidant status in osteoarthritis is not clear. The objectives of our study to evaluate the changes in oxidative stress marker (lipid-peroxidation) and non-enzymatic antioxidant (glutathione) in osteoarthritis patients. This study was carried out in 50 osteoarthritis and 50 normal individuals. Levels of Lipid-peroxidation marker MDA and GSH were measured by UV-VIS spectrophotometer. Increased serum MDA level is found in OA as compared to control. Significantly decreased GSH found in OA as compared to control. The result shows increased oxidative stress and decreased non-enzymatic antioxidant in osteoarthritis patients.

Index Terms- osteoarthritis, oxidative stress, lipid-peroxidation, MDA, GSH, non-enzymatic antioxidant

I. INTRODUCTION

Osteoarthritis (OA) is a slow progressive disorder of synovial joints. This joints disorder is characterized by a loss of balance between synthesis and degradation of the articular cartilage constituents leading to subsequent erosion of joint cartilage remodeling of the underlying bone osteophyte formation and variable degree of Synovitis.[1]

The main symptom is pain, causing loss of ability and often stiffness. "Pain" is generally described as a sharp ache or a burning sensation in the associated muscles and tendons. OA can cause a crackling noise (called "crepitus") when the affected joint is moved or touched and people may experience muscle spasms and contractions in the tendons. Occasionally, the joints may also be filled with fluid. Some people report increased pain associated with cold temperature, high humidity, and a drop in barometric pressure, but studies have had mixed results.[2]

Lipid Peroxidation mediated by free radicals is considered to be the major mechanism of cell membrane destruction & cell damage. Antioxidants are compounds that dispose, scavenge, & suppress the formation of free radicals or oppose their actions. This study evaluates the association between lipid Peroxidation & non-enzymatic antioxidant marker in osteoarthritis Patients.

To the best of our knowledge, only very few studies have been performed with respect to the estimation of the serum malondialdehyde and non-enzymatic antioxidant levels in patient with osteoarthritis & their role in prevention & treatment of osteoarthritis. In the light of this explanation, the present study was undertaken to determine the levels of the lipid peroxidation marker MDA and non-enzymatic antioxidant (GSH) in the serum of osteoarthritis patients.

II. MATERIAL AND METHOD

The present study was conducted on 50 controls and 50 clinically established osteoarthritis patients attending the Out Patient Department of orthopedics OPD diagnosed by orthopedician, PBM hospital affiliated to SP Medical College, Bikaner. Serum MDA and GSH level was measured by UV-VIS spectrophotometer. A thorough physical examination was carried out on all the patients. Routine hematological & radiological investigation was also done. The presence of osteoarthritis in patients was diagnosed by carrying out X- ray analysis of joint destruction as well as C-reactive protein & antinuclear antibody test. This study was also approved by the institutional ethical committee.

Inclusion Criteria: Subjects with normal nutritional habits without supplementing with any vitamins during the last three months included in the study.

Exclusion Criteria: None of these subjects were alcoholic or chronic smoker & none of them suffered from any systemic diseases like hypertension, diabetes, not having any history of trauma to joints & also subject's history of receiving any anti-inflammatory drugs in the three months were excluded from the study.

MDA concentration will be estimated as reactive substances by a Thiobarbituric acid assay method described by **Buege and Aust (1978)**.[3] The reduced glutathione was estimated by kit method. All estimation was done within 24-48 hrs. after specimen collection.

III. RESULT

In present study, serum Malondialdehyde (MDA), reduced glutathione (GSH) levels were estimated.

Table 1: Levels of serum MDA, reduced glutathione, in patients with osteoarthritis and controls.

Study group	MDA (nmol/ml) Mean +/- SD	GSH (mg/dl) Mean +/- SD
Patients (50)	1.719 +/- 0.44	12.2076 +/- 1.414
Controls (50)	3.2722 +/- 1.153	9.2076 +/- 1.140

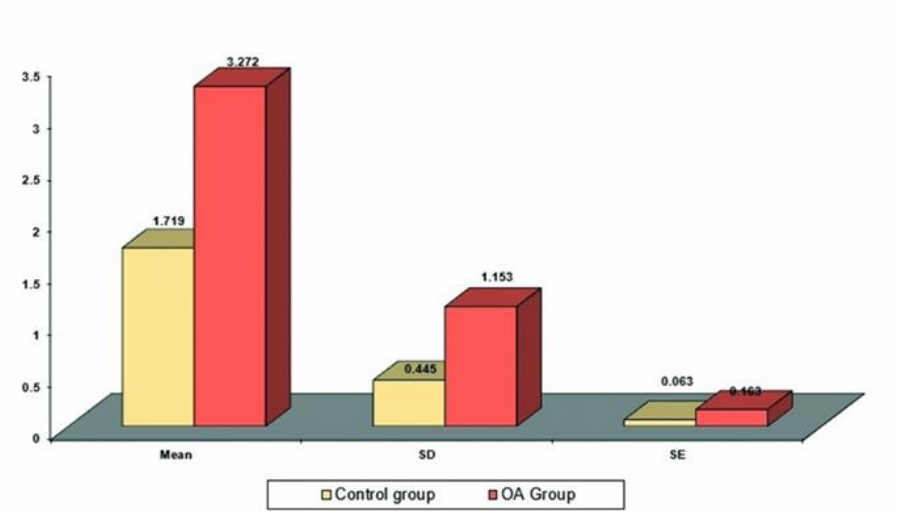
Table 2: Comparison of mean values of blood parameters in normal control subjects with Osteoarthritis (OA)

Blood Parameters	***Normal Control subjects. (n=50)***		***Osteoarthritis Patients (OA) (n=50)***		***Significant***	
	Mean ± S.D.	**S.E.**	**Mean ± S.D**	**S.E.**	**t**	**P**
Malondialdehyde (MDA) nmol/ml	1.719 ± 0.445	0.063	3.272±1.153	0.163	8.879	**0.0001 HS*****
Reduced Glutathione (GSH) mg/dl	12.207±1.414	0.200	9.207±1.140	0.161	111.675	**0.0001 HS*****

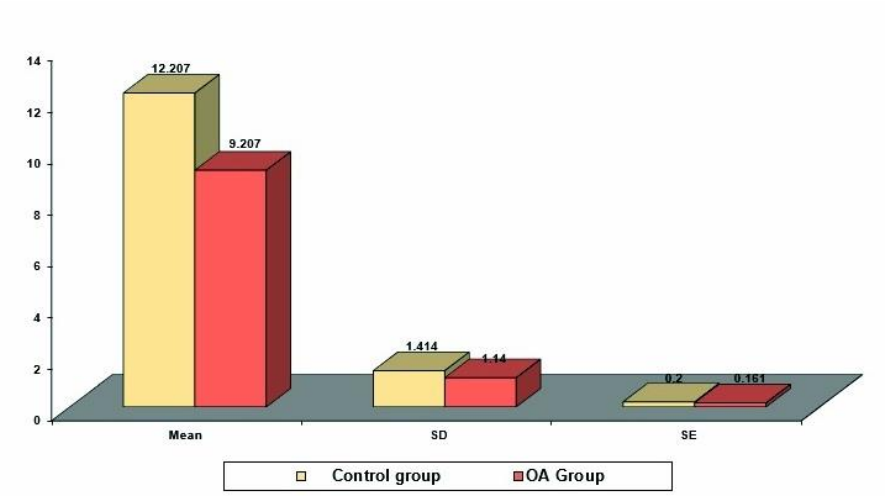
The serum MDA levels in the osteoarthritis patient was 3.27±1.153 nmol/ml which was significantly higher than that of controls (1.72±0.44 nmol/ml) (P<0.0001). The results of present study of serum MDA was similar to results obtained by previous studies which suggested that serum MDA level in osteoarthritis patients increases significantly as reported by Maneesh et al (2005)[4], Amal et al (2011)[5] and Manoj et al (2013).[6]

Reduced Glutathione (non-enzymatic antioxidant) levels were also significantly decreased in osteoarthritis patients than controls (12.20±1.414 vs. 9.20±1.14 mg/dl) (P<0.0001). The results of present study obtained by previous studies which suggested that serum GSH level in osteoarthritis patients might be due to higher oxidative stress either due to increased extent of lipid peroxidation or due to decreased levels of antioxidants and concordant with the studies of Maneesh et al (2005).[4] Agnieszka et al (2012).[7] and Manoj et al (2013).[6]

Graph-1: Serum MDA level in osteoarthritis patients & controls (MDA conc. in nmol/ml)



Graph-2: Reduced Glutathione (GSH) levels in osteoarthritis patients & controls (reduced glutathione conc. in mg/dl)



IV. DISCUSSION & CONCLUSION

Osteoarthritis is characterized by increased markers of oxidative stress. Recent studies have suggested that human articular Chondrocyte can actively produce reactive oxygen species (ROS). ROS are released during inflammation of the Synovial membrane of synoviocyte. These radical oxygen species with oxidative activity play an important role in the Chondrocyte catabolic program being the mediators and effecters of cartilage damage. The damaging effect of the process is initiated by a chain reaction that provides continue supply of free radicals which initiates further Peroxidation.

The present study showed significant increase in lipid Peroxidation product MDA & significant decrease in non-enzymatic antioxidant marker reduced glutathione. Since MDA is an index of lipid Peroxidation, its level was estimated in patients with osteoarthritis to estimate the extent of lipid Peroxidation.

MDA levels were found to be significantly increased in osteoarthritis patients than in healthy individuals, indicating an increase in the process of lipid Peroxidation in osteoarthritic patients. Results are in agreement with Ruby K B. I et al (1998)[8], K. K. Mane et al (1999)[9] and Tiku et al (2000 & 2003)[10,11].

Reduced glutathione a non-enzymatic antioxidant marker estimated in OA and healthy subjects (control). Reduced glutathione levels were found to be significantly decreased in patients with osteoarthritis than in healthy subjects indicating inadequate antioxidant mechanism in patients suffering from osteoarthritis. Results are in agreement with M Maneesh et al (2005),[4] suprapaneni Krishnamohan (2007)[12] and Manoj et al (2013).[6]

From the above discussion it is presumed that oxidative stress involved in pathogenesis of OA which results due to increased free radical production. This leads to alteration in the antioxidant status which varies with the individual antioxidant depending upon their biochemical action. This is evident by noting significant decreased in GSH. Further research required in this area to know the status of other antioxidant marker & about their beneficial therapeutic effect in the management of osteoarthritis.

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