



ANTI-OXIDANT LEVELS IN PATIENTS WITH RHEUMATOID ARTHRITIS PATIENTS

Anjani Kumar

Associate Professor, Department of Orthopaedics, Sri Lakshmi Narayana Institute of Medical Sciences, Affiliated to Bharath University, Pondicherry, India,

Prof. Dr. E. Prabhakar Reddy*

Professor of Biochemistry, Bharath Medical College and Hospital, Chennai, Affiliated to BIHER, India. *Corresponding Author

ABSTRACT

Rheumatoid arthritis (RA) is an autoimmune disorder, occurs when there are attacks of the immune system on body's tissues especially the joint, causing a painful, swelling, that finally results in bone deformity, increased free radical level in defect joint and reduce the level of the antioxidant system can cause tissue damage. Autoimmune phenomena and damage of connective tissue within the synovial joint can be resulted from oxidative stress formed within inflamed joint. Radical species that possess oxidative activity, which include reactive nitrogen species (RNS) and reactive oxygen species (ROS), mediate and cause cartilage damage. Rheumatoid arthritis (RA) is a chronic progressive inflammatory autoimmune disorder characterized by symmetric erosive synovitis and sometimes with multi-system involvement. But the exact mechanism of the disease is not fully understood. In the light of above explanation, the present study measured the plasma levels of Total Antioxidant capacity (TAC), and malondialdehyde (MDA) levels were measured to establish plasma oxidant/antioxidant status in the patient and control groups. Fasting blood samples were obtained from 30 patients with RA and 30 control subjects. The study raise the concept that oxidative stress as evidenced by increased MDA, and decreased TAC may play a key role in the pathogenesis of RA. The study also indicated a strong relationship between oxidative stress and rheumatoid arthritis.

KEYWORDS : Reactive Oxygen Species, Rheumatoid Arthritis, Oxidative Stress, total Antioxidant Capacity

INTRODUCTION:

Rheumatoid arthritis (RA) is a chronic progressive autoimmune disorder characterized by symmetric erosive synovitis and some times shows multisystem involvement [1]. While lowered concentrations of antioxidants in the blood considerably increase the probability of the occurrence of RA [2]. Many investigators have focussed on oxidative stress since last few years and suggest that RA patients are more prone to lipid peroxidation [3]. Numerous scientific investigations confirmed the occurrence of oxidative stress in rheumatoid arthritis patients. There is evidence demonstrating elevated levels of oxidative stress markers and oxidative damage caused by reactive oxygen species (ROS) to lipids, proteins, sugars, and DNA, as well as a significant decrease in total antioxidant capacity, which protects the organism against ROS activity. Extensive ROS production can significantly accelerate the process of articular cartilage damage. Oxygen metabolism has an important role in the pathogenesis of rheumatoid arthritis. Reactive oxygen species (ROS) produced in the course of cellular oxidative phosphorylation, and by activated phagocytic cells during oxidative bursts, exceed the physiological buffering capacity and result in oxidative stress. The excessive production of ROS can damage protein, lipids, nucleic acids, and matrix components. They also serve as important intracellular signaling molecules that amplify the synovial inflammatory-proliferative response [4]

Increased lipid peroxidation and decreased enzymic and non-enzymic antioxidants in RA. oxidant stress plays a very important role in the pathogenesis of RA [5]. There was an increased oxidative stress and a low antioxidant status in patients with RA. These changes are probably due to efforts for reducing lipid peroxidation and hence to lower tissue damage [6]. This oxidative stress may contribute to the cyclic self-perpetuating nature of rheumatoid inflammation [7]. there could be an important role of oxygen radicals, especially, when considering possible alterations in matrix and enzymes that degrade the matrix. In vitro studies demonstrated that enzymatically generated superoxide radicals produce hypochlorite ions. It has been focussed that this hypochlorite can depolymerise purified hyaluronic acid

and damage protease inhibitors, resulting in uncontrolled activity of proteases [8-9].

This study aims to elucidate plasma oxidant/antioxidant status in patients with rheumatoid arthritis (RA). Patients of the present study were from the outpatients attending Rheumatology clinic of a tertiary care teaching hospital. Fasting blood samples were obtained from 50 patients with RA and 50 control subjects. Total Antioxidant capacity (TAC), and malondialdehyde (MDA) levels were measured to establish plasma oxidant/antioxidant status in the patient and control groups. This study is to evaluate whether oxidative stress has a role in the pathogenesis of RA.

MATERIAL AND METHODS:

The sample was taken from a group of 50 patients with RA (25 male and 25 female), age (45-70 years). The 50 healthy controls (25 male and 25 female) were diagnosed if they having any diseases such as diabetes, infectious diseases. Fasting blood samples were obtained from 50 patients with RA and 50 control subjects. Total Antioxidant capacity (TAC), and malondialdehyde (MDA) levels were measured to establish plasma oxidant/antioxidant status in the patient and control groups.

Statistical analysis:

Results were expressed as mean and standard deviation (SD). Comparison between two variables were done using Student's t test.

RESULTS:

Table.1: A comparison of Mean \pm SD Levels and p value of MDA, G6PD AND Total Antioxidant Capacity levels in Arthritis Patients control subjects

Parameters	Control (n=50)	RA patients (n=50)	p Value
MDA nmol/dL	129.6 \pm 3.32	148.76 \pm 7.75	p<0.001
G6PD U/gm of Hb	12.9 \pm 2.11	26.2 \pm 2.21	p<0.001
Total Antioxidant Capacity (μ mole/l)	1.39 \pm 0.14	0.48 \pm 0.09	p<0.001

Statistical Analysis:

Statistically significant increase in MDA levels in patient group

and Decreased levels were found when compared with control group ($p < 0.05$)

DISCUSSION:

Generation of reactive oxygen species is an important factor in the development and maintenance of rheumatoid arthritis (RA) in humans. MDA, the product of lipid peroxidation reacts with lysine residues in protein to produce immunogenic molecules, which can exacerbate inflammation. The longer chain polyunsaturated fatty acids are especially potent at increasing lipid peroxidation and causing cell damage by oxidative stress [10]. RA is associated with collection of chronic inflammatory cells occurring adjacent to bone with subsequent bone destruction. It is possible that generated oxygen derived free radicals may be important in bone resorption. There is remarkable elevation of MDA levels in patients with RA compared to control. A similar study was conducted by the Departments of Medicine and Biochemistry at All India Institute of Medical Sciences, New Delhi, where the compared the levels of MDA in RA with healthy controls and patients with Osteoarthritis (OA). Their study showed that serum MDA levels in RA were significantly higher than healthy controls [11]. Similar observations are also noted in many other published studies [12-15]. G6PD activities of RA cases in RBCs were elevated compared to controls ($p < 0.001$). This could be due to disinhibition of G6PD, a regulatory enzyme of HMP pathway. In this, coenzyme NADPH generated mainly by G6PD of HMP shunt pathway is consumed and its oxidised form, NADP is released. This causes disinhibition of G6PD, the regulatory enzyme of HMP shunt pathway. This is reflected as raised activity of G6PD in the study. The antioxidant defense system is compromised in rheumatoid arthritis patients. There is a shift in the oxidant/antioxidant balance in favor of lipid peroxidation, which could lead to the tissue damage observed in the disease. Oxygen free radicals have been implicated as mediators of tissue damage in rheumatoid arthritis (RA).

Therapeutic coadministration of antioxidants along with conventional drugs to such patients has been considered beneficial. MDA is a product of lipid peroxidation and thereby functions as a marker of oxidative stress. The level of MDA in plasma or serum has been reported to be higher in RA patients than in control subjects and it is an indication of oxidative stress in these patients and Patients with RA had lower levels of TAC were found when compared with controls which is an indication of reduced antioxidant capacity in these patients and these two parameters will give a more comprehensive evaluation into oxidant/antioxidant status. It could be seen as an indication of reduced antioxidant capacity and oxidant stress in RA patients. Suggest that the antioxidant system is impaired and peroxidation reactions are accelerated in patients with RA.

CONCLUSION:

Increased oxidative threat in rheumatoid arthritis is evidenced by raised lipid peroxides. With a better understanding of the pathophysiology of RA, new therapeutic approaches are emerging to provide precision medicine for individuals. As expected RA patients had higher levels of MDA and lower levels of TAC than healthy controls. Indicating that the antioxidant system is impaired and peroxidation reactions are accelerated in patients with RA. Overproduction of free radicals by inflammatory processes in RA causes oxidative injury and damage antioxidant defence system in RA patients. The elevated lipid peroxidation in plasma in the present study, indicated by elevated MDA can be related to a compensatory defence system in RA.

REFERENCES:

1. Taysi, S., Polat, F., Gul, M., Sari, R. A. and Bakan, V. (2002) Lipid peroxidation, some extracellular antioxidants and antioxidant enzymes in serum of patients with rheumatoid arthritis. *Rheumatol. Int.* 21, 200-204.
2. Sklodowska, M., Gromadzinska, J., Biernacka, M., Wasowicz, W., Wolkanin, P., Marszałek, A., Brozik, H. and Pokuszynska, K. (1996) Vitamin E, thiobarbituric acid reactive substance concentrations and Superoxide Dismutase activity in the blood of children with juvenile rheumatoid arthritis. *Clinical and experimental Rheumatology* 14, 433-439.
3. Serdar Ozturk, H., Burak Cimen, M.Y., Bolgen Limen, O., Kacmaz, M. and Durak, I. (1999) Oxidant/antioxidant status of plasma samples from patients with rheumatoid arthritis. *Rheumatol. Int.* 19, 25-37.
4. Edward D Harris Jr, William N Kelley, Shaun Ruddy, Clement B Sledge. *Text book of Rheumatology*. 4th ed. 1993; Vol: 1, p 833.
5. Plasma lipid peroxidation and antioxidant levels in patients with rheumatoid arthritis. A. Kamanlı, M. Nazroğlu, N. Aydılek, C. Hacıyayagil *Cell Biochem Funct* 2004; 22: 53-57.
6. Antioxidant status & lipid peroxidation in patients with rheumatoid arthritis F. Karataş, I. Özates, H. Canatan, I. Halifeoğlu, M. Karatepe, R. Çolak *Indian J Med Res* 118, October 2003, pp 178-181.
7. Nurcomb HL, Bucknall RC, Edward SW. Activation of neutrophil myeloperoxidase – hydrogen peroxide system in synovial fluid isolated from patients with rheumatoid arthritis. *Ann. Rheum. Dis.* 1991; 50:237.
8. McCord JM. Free radical and inflammation - Protection of synovial fluid by superoxide dismutase. *Science*. 1974; 185:529.
9. Situnayake RD et al. Chain breaking antioxidant status in rheumatoid arthritis: Clinical and Laboratory correlates. *Ann Rheum. Dis.* 1991; 50:81.
10. Darlington, L.G. and Stone, T.W. (2001) Antioxidants and fatty acids in the amelioration of Rheumatoid arthritis and related disorders. *Br. Journal of Nutr.* 85, 251-269.
11. Chaturvedi V, Handa R, DN Rao, JP Wali. *Ind J of Med. Resear.* May 1999; p 170-74. [20] Kalavacherla US, Ishaq M, Rao UR, Sachindranath A, Hepsiba T. Malon di aldehyde as a sensitive marker of inflammation in patients with RA, *J Assoc Physicians India* 1994 Oct; 42(10):775-6.
12. Amal Mohamad El Barbary, Manal Aly Abdel Khalik, Alaa Mohamad Elsalawy et al. Assessment of lipid peroxidation and antioxidant status in Rheumatoid arthritis and Osteoarthritis, *The Egyptian Rheumatologist*, Elsevier, 2011; 33 (4): 179-185.
13. Gambir JK, Lali P, Jain AK. Correlation between blood antioxidant levels and lipid peroxidation in rheumatoid arthritis. *J Clin. Biochem*, Elsevier, 1997; Vol 30, p 351-5
14. S Jaswal, HC Mehta, AK Sood, J Kaur. Antioxidant status in RA and role of antioxidant therapy. *Clin Chem Acta*, 338, 2003; p 123-9.
15. H Ozgunes, H Gurer, S Tuncer, Correlation between plasma MDA and ceruloplasmin activity values in RA, *Clin Biochem*, 28, 1995; p 193-4.