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MALON DIALDEHYDE, CALCIUM, PHOSPHORUS LEVELS IN RHEUMATOID ARTHRITIS PATIENTS

Orthopaedics

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ABSTRACT

Rheumatoid arthritis (RA) is an inflammatory polyarthritis, leading to joint destruction, deformity and loss of function. 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.Serum levels of lipid peroxides, calcium, phosphorus in RA patients were determined and compared with normal healthy controls. Significant increases in lipid peroxides ($p<0.001$) phosphorus ($p<0.001$) levels were found in patients presenting with RA as compared to controls. Whereas significant decrease in calcium ($P<0.001$) were found in Rheumatoid arthritis patients as compared to controls.

KEYWORDS

Rheumatoid Arthritis (RA),Malondialdehyde,Calcium,Phosphorus

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).The calcium role is not clear in RA, however, the relationship between calcium, vitamin D, and parathyroid hormone suggests the possible role of calcium in RA and there is a change in mineral within bone which are calcium, and phosphorus (3). Changes in lipid profile have been observed in different inflammatory disease such as RA (4). RA patients are in increased risks of atherosclerosis and cardiovascular diseases (CVD) than the overall population (5). Bone contains both organic and inorganic material. The organic matter is mainly protein; the inorganic or mineral component is mainly crystalline hydroxyapatite {Ca10(PO4)6(OH)2}. Approximately of body's 99% Calcium and 85% Phosphorus are present in bone. The exact reason behind bone erosion and joint deformities is not fully understood.

This study was aimed to study MDA level as a marker of oxidative stress in patients with RA as well as the changes in Ca, and P level in recently diagnosed RA patients compared to healthy subjects and there is continuing interest in the metabo.

Material and Methods:

The sample was taken from a group of 100 patients with RA (50 male and 50 female), age (45-70 years). The control was diagnosed if they having any diseases such as diabetes, infectious diseases. RA was diagnosis based on clinical histories such as ESR and rheumatoid factor.

Statistical analysis:

Statistical analysis was done by using student t-test to compare between the two groups and statistically significance set at $p<0.05$. The data of this study were given as mean ± standard deviation. Results were diagnosed with rheumatoid arthritis at SLIMS hospital with 100 healthy people who represent controls.In this study patient with RA belonged to the age group of 45-70 years. Among patients of RA 50 patients were males and 50 were females as shown in table 1. The mean±SD of age in males was 53.21±8.12 and the mean±SD of the female was 55±11.1.

RESULTS:

Table. 1: Serum levels of Malomdialdehyde (MDA), calcium, phosphorus and calcium/phosphorus in control subjects and rheumatoid arthritis patients.

Our results shows comparison of MDA, Calcium and Phosphorus levels in RA with control subjects. Statistically significant increase in levels of lipid peroxide ($P<0.001$) and phosphorus ($P<0.001$) whereas statistically significant decrease in Calcium ($P<0.001$) was found in patients of RA as compared to control subjects. whereas phosphorus level was increased significantly ($P<0.001$) in RA patients as compared to control subjects.

DISCUSSIONS :

Rheumatoid arthritis (RA) is an inflammatory polyarthritis, leading to joint destruction, deformity and loss of function. Extra-articular features and systemic symptoms usually occur and may accompany the onset of joint symptoms. Lower calcium level may be due to insufficient calcium intake and quicken osteoporosis, more sodium intake in our food may cause calcium depletion (6). Free radical that produced by ROS that case chronic inflammatory cells nearby bone with subsequent bone destruction (7). RA is usually associated with localized or generalized osteoporosis, erosions and hand and generalized bone mineral density (BMD) loss resulting in functional disability and increased risk of clinical fractures. Many drugs shave an affected-on calcium metabolism and cause a low level of calcium in RA. It was assuming that high level of phosphorous was related to tissue hypoxia with an elevated in ATP breakdown resulting in the release of inorganic phosphorous from cells. However, hypoxia create by hypertrophy and hyperplasia within synovial joints [(8). It was observed that Calcium in RA a low level in serum whereas Phosphorous has shown a high level in contrast to control, that can be concluded to be a danger factor for RA cases. These results recommend to increase Mg, Ca, P in the dies with a supplement that might be helpful for a patient with RA. Further studying is necessary to estimate various biochemical markers that influences patient with RA. Statistical analysis by unpaired t test shows that the levels of serum calcium were decreased and phosphorus levels were increased statistically, which were highly significant ($p<0.0001$).Low calcium may be due to prolonged inadequate calcium intake and accelerated osteoporosis. In RA patients as compared to healthy controls. These results are in accordance with several other studies(9-13).

RA patients are vulnerable to steroid induced and disease associated osteoporosis. The high salt intake in our population may exacerbate calcium deficiency. At the proximal tubule, were sodium and calcium absorbs option are linked. Although not specifically studied, many disabled people rely heavily on pre-packed food and meals, much of which is high in sodium (14). 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 (15). It is possible that, generation of reactive oxygen species may be particularly important factor for bone resumption in inflammatory process (16). Hypoxic conditions also disrupt an intracellular ionic environment and alter calcium and phosphorus level (17).There is an altered calcium and

phosphorous metabolism in RA. As calcium and phosphorous are important constituent of bone, ultimately bone metabolism is altered in RA, the event observed by many workers (18-19).

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 (20-21). The longer chain polyunsaturated fatty acids are especially potent at increasing lipid peroxidation and causing cell damage by oxidative stress (22).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.

It is postulated that the elevation of phosphorous was related to tissue hypoxia with an increase in ATP degradation resulting in the release of inorganic phosphorous from cells.In RA, hypoxic environment triggers oxygen free radicals generation and alters oxidative metabolism within the cell. It leads to disruption in intracellular ionic environment and altered calcium and phosphorus levels. Some authors suggest that hypocalcemia results due to drugs used in RA, but decreased mean total body calcium levels in RA patients who did not received that corticosteroid drugs strongly suggest that, this is an integral feature of RA (23-25).

CONCLUSION:

Calcium and Phosphorus level can be studied for the preferable therapeutic management of RA. In patients serum levels of calcium and calcium/phosphorus decreased and further studies on dietary management of calcium and phosphorus are needed. 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.

Table. 1: Serum levels of Malondialdehyde (MDA), calcium, phosphorus in control subjects and rheumatoid arthritis patients.

Sr. no	Parameters	No. of Subjects	Control Subjects	Rheumatoid Arthritis patients
1	Serum Malon di aldehyde (MDA) µmol/L	100	1.98 ± 0.67	4.88 ± 1.52*
2	Serum Calcium (mg/dl)	100	10.65 ±	7.98 ± 1.48*
3	Serum inorganic phosphorus (mg/dl)	100	2.95 ± 0.40	4.95 ± 0.92*

Values are expressed as mean ± SD; *P < 0.001

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