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Study of Mineral Status & Alkaline Phosphatase Activity in Rheumatoid Arthritis Patients in Western Rajasthan

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Abstract: ***Rheumatoid arthritis (RA) is a chronic systemic autoimmune disease that primarily affects the lining of the synovial joints. It arises more frequently in females than males, being predominantly observed in the elderly. As, RA is an inflammatory disease and phosphorous, calcium and magnesium levels are altered in chronic inflammation. Similarly, it predominantly affects bone, and Alkaline Phosphatase is a biochemical marker of bone turnover.***

Keywords: RA patients, inflammation, calcium, phosphosrus

1.Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disease, associated with progressive disability, systemic complications and financial costs for the individual and for society. The term "rheumatoid arthritis" originates from the Greek words "rheum" and "arthro" and the suffix "-itis" which means flow, joint and inflammation, respectively. The terminology is based on the idea that human diseases originated from imbalance between body fluids. (1)

Autoimmune diseases caused due to dysfunction of the immune system have now unequivocally regarded as the most significant clinical problem, as they affect nearly 23.5 million Americans and with increasing prevalence.(2) The dysfunction of the immune system leads to the production of autoantibodies against the healthy cells, tissues and organs. Based upon the impact, severity, and the organs affected, more than 80 autoimmune diseases have been identified. Overall, women have a more than twofold higher incidence of RA than men. This is mainly due to an increased risk for women during their reproductive years, when the incidence shows a female/male ratio of 4-6:1 (3-5) Peak incidence of RA in women occurs after the menopausal age. (3,4) RA is rare in men aged less than 45 years of age, but the incidence rises steeply with age.(4)

The prevalence of RA in females has increased from 0.8% (7.7 per 1000) in 1995 to 1% (9.8 per 1000) in 2005 but the prevalence has remained constant among males in both 1995 and 2005 at 0.4%.(6) The incidence rate increased by 2.5% each year from 1995 to 2005 among females but decreased by 0.5% per year among males.(6) .

The non genetic factors such as smoking, air pollution and silica and asbestos is the dominant environmental risk factor and doubles the risk of developing rheumatoid arthritis .(7)

Recently various biochemical parameters in RA are being explored by many studies. There is paucity of information regarding the pattern of biochemical parameters like, magnesium, total proteins, albumin, globulin, glucose, urea, Creatinine, bilirubin and various enzymes like transaminases in RA.

2.Material and Methods

The present observational **cross-sectional** study was conducted in the Department of Biochemistry in association with the section Physical Medicine and section Rehabilitation of the Department of General Medicine of Sardar Patel medical college & Associated Group of Hospitals, Bikaner, Rajasthan. The subjects were selected based on the following inclusion and exclusion criteria.

Inclusion Criteria

All patients in the age group of 45 to 60 years attending the General Medicine and Physical Medicine and Rehabilitation Department with symptoms of joint pain and clinically diagnosed as Rheumatoid Arthritis.

Exclusion Criteria

1. All the patients of either sex in the age group of 30 to 45 years were excluded from the study.
2. All the Participants with premature ovarian failure, bilateral ovariectomy, hormone replacement therapy, contraceptives, corticosteroids > 7.5 mg daily, or malignant tumors were excluded.
3. All the Smoker females and those whom were previously diagnosed with any type of autoimmune diseases were excluded from the study.
4. Known cases of RA who was taking anti-rheumatic treatment (including anti-inflammatory and /or glucocorticoids), patients suffering from diabetes mellitus, endocrine disorders, tuberculosis, cardiovascular, liver, kidney disease, obese (BMI > 30), patients taking lipid lowering drugs or any other

therapy including vitamins and minerals and trauma cases were excluded from the study.

Sampling Procedure

Under aseptic precautions,7-8 ml of venous blood samples was collected and allowed to incubate for 30 minutes at 37^0C, centrifuge at 3000 rpm for 15 min for separation of serum.

Precautions were taken to avoid haemolysis & other contamination and separated serum were analysed for test parameters. After that System reagents used for the quantitative determination of $Ca^{2+,}$ $Mg^{2+,}$ Phosphorus and alkaline phosphatase in human serum on Beckman Coulter analyzer (AU680).

Statistical Analysis

All the results were expressed as mean ± SD values. Independent t-test of two means was used for the comparison between both groups. P values < 0.05 was considered significant and pearson correlation was performed. SPSS statistical software (version 24.0) was used for data analysis.

3.Observation

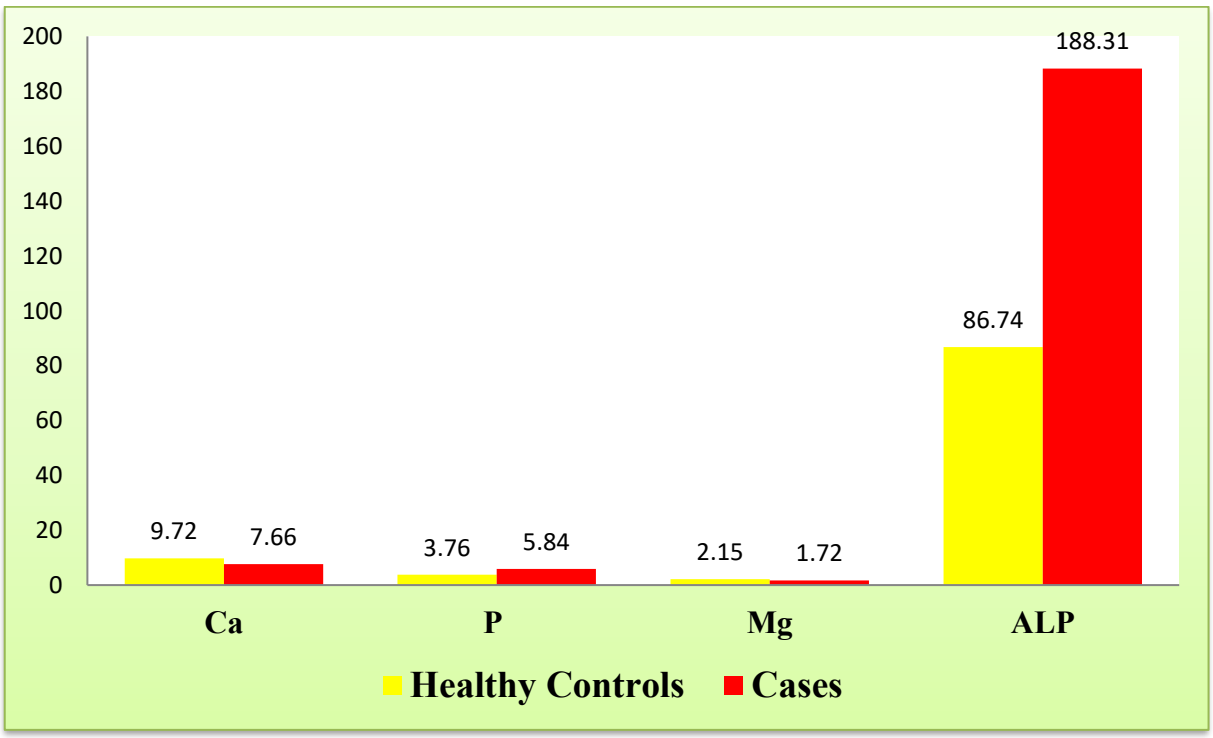
The mean age of participants was comparable between the two groups, with healthy controls at 50.10 ± 10.54 years and cases slightly older at 52.16 ± 11.35 years. This similarity in age reduces potential confounding effects, allowing for clearer interpretation of hormonal and biochemical differences.

RA cases exhibited significant disturbances in mineral metabolism. Serum calcium was significantly lower in RA patients (7.66 ± 0.79 mg/dl) compared to controls (9.72 ± 0.60 mg/dl; t = −13.13, P < 0.0001), whereas phosphorus levels were markedly higher (5.84 ± 0.63 mg/dl vs. 3.76 ± 0.61 mg/dl; t = 15.00). Magnesium levels were reduced in RA cases (1.72 ± 0.15 ng/ml) versus controls (2.15 ± 0.23 ng/ml; t = −9.90), while ALP levels were substantially elevated (188.31 ± 26.69 IU/L vs. 86.74 ± 17.46 IU/L; t = 20.14). Collectively, these findings indicate a clear imbalance in bone mineral homeostasis in RA patients.

Table 1: Statistical analysis of serum Ca, P, Mg and ALP in both the studied groups

S. No	Parameters	Healthy Control Group (Mean ± S.D.)	RA Group (Mean ± S.D.)	T- test	P value
1.	Calcium (mg/dl)	9.72 ±0.60	7.66 ± 0.79	-13.13	P<0.0001
2.	Phosphorus (mg/dl)	3.76 ±0.61	5.84 ± 0.63	15.00	
3.	Magnesium (ng/ml)	2.15 ±0.23	1.72 ± 0.15	-9.90	
4.	ALP (IU/L)	86.74 ±17.46	188.31 ± 26.69	20.14	

Note: p < 0.0001 = Highly significant



Graph 1: Graphical representation of mean Ca, P, Mg and ALP in both groups

4.Discussion

Consistent to our results Buckman et al[8] reported that rheumatoid arthritis was less recorded among the younger age group as compared to the older age group with a mean age of 51.25 years in their study. Lee et al[9] reported mean age of 51.8 years among the study population with female preponderance (around 86% were females in their study (Buckman -08).

In consistent with our results Sridevi and Anand[10] observed that serum ALP was found to be raised in patients of rheumatoid arthritis when compared to the healthy controls. Elevated ALP in rheumatoid arthritis has been attributed to osteoblastic activity indicating an increased bone turnover.

Decrease in magnesium levels in RA may be due to chronic inflammation and autoimmune injury. Sathe et al also reported that calcium levels are significantly decreased in rheumatoid patients, whereas alkaline phosphatase levels are significantly increased as compared to control subjects. Serum phosphorus levels are increased non-significantly than controls. Menzes et al study reported, the concentrations of serum calcium and phosphorus are usually reduced and serum alkaline phosphatase activity was elevated in RA patients.

Overall, the findings show that RA patients have significant hormonal changes and disturbances in mineral and bone metabolism. This emphasizes the importance of monitoring minerals status in RA patients, as it may help in understanding disease progression and guiding better management strategies.

Limitations of the study & Recommendations

Limitations of our study are small sample size and non-measurement of other markers of inflammation & Cardiovascular risk factors in patients with Rheumatoid Arthritis. Moreover, a large cross-sectional study needs to be done to conclude the fact.

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Conflict of Interest: None

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