

Effect of Clinical Depression on Serum Glucocorticoids and Bone Mineral Density in Osteoporotic Patients

Priyanka Pahari¹, Vinita Ailani², Julie Bhattacharya³, Ritwik Ganguli⁴

¹Assistant Professor of KPCMCH, Kolkata & PhD scholar of NIMS University, Jaipur,

^{2, 3}Professors of Physiology department, ⁴Associate Professor of orthopaedics department [MBBS, MS (orth.), DNB (orth.), Fellowship in arthroscopy & sports medicine (Japan)]

Name of the institution: ^{1, 3, 4}KPC Medical College & Hospital, Jadavpur, Kolkata,

²National Institute of Medical Sciences University, Jaipur.

Corresponding Author: Vinita Ailani

Abstract

Background: Several studies on osteoporosis established that bone health is maintained by a complex interplay of hormones. The relationship between depression and bone mineral density (BMD) is yet to be ascertained. Depression globally identified as an emerging non-infectious cause of morbidity and mortality, has been found to induce changes in bone-brain-nervous system.

Aim: The aim of this present study is to find the correlation between depression, serum cortisol and BMD and thereby role of hypothalamic-pituitary-adrenocortical (HPA) axis in inducing osteoporosis.

Materials and methods: The study group consisted of 80 osteoporotic patients age range between 30-80 years. BMD was measured by DEXA (dual-energy X-ray absorpt). Quantitative serum cortisol measured by ELISA. The state of depression was analysed by using Ham D scale. Statistical correlation between the parameters was computed by using MS Excel 2007 and SPSS 22 software.

Results: A highly significant ($P < 0.00001$) correlation was observed between HAM-D score and serum cortisol ($R = 0.56$). The correlation between HAM-D and BMD was also significant ($P < 0.05$). No significant correlation was found between BMD and serum cortisol ($P > 0.05$, $R = -0.17$).

Conclusion: It can be concluded that though high score of depression correlated with low BMD which was not essentially due to raise of serum cortisol alone, there are yet others metabolic factors besides cortisol which effects the BMD score of individuals. Future research is needed to focus on modification of osteoporotic risk by other endocrine and metabolic factors.

Keywords: Bone-brain-nervous system, BMD, Cortisol, Depression, HPA axis.

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I. Introduction

World Health Organisation (1994) defined Osteoporosis as a BMD that lies 2.5 standard deviations or more below the average value for young healthy Caucasian women (a T-score < -2.5 SD)¹.

National Osteoporosis Foundation characterized Osteoporosis as a disease with low bone mass and micro-architectural deterioration of bone tissue, leading to bone fragility and an increased susceptibility to fractures². Depression globally identified as an emerging non-infectious cause of morbidity and mortality, has been found to induce changes in bone brain-nervous system³.

Osteoporosis in menopausal women is becoming a major public health problem in India and still Indian research in this field is far behind. This health issue in India is different from the rest of the world as normative index of Indian women is lower as compared to their western counterparts. This emphasizes the need for early screening of osteoporosis and early identification of high-risk groups so that early initiation of treatment can be achieved⁴.

Hypercortisolemia is considered an important causative factor for bone deficits in depression. Depression causes a sustained and protracted activation of the stress system, stimulating the release of hypothalamic corticotrophin releasing hormone (CRH) via circuits connecting the prefrontal cortex, the hippocampus, the amygdala, and the hypothalamus, and thereby increasing cortisol secretion, which alters bone health by decreasing bone formation and increasing bone resorption^{5,6}.

A physiological theory is that depression activates the hypothalamic-pituitary axis with effects such as increased levels of cortisol that have known deleterious effects on bone⁷.

The relationship between depression and bone mineral density (BMD) is yet to be ascertained.

Major gaps still remain in the diagnosis and management of osteoporosis, thus highlighting the need for more structured research in this area.

Aims and Objectives

- The aim of this present study is to find the correlation between clinical scoring of depression, serum cortisol and BMD and thereby role of hypothalamic-pituitary-adrenocortical (HPA) axis inducing osteoporosis.
- To measure the effect of clinical depression on serum cortisol level and BMD
- To determine the relationship between serum cortisol and bone mineral density.

II. Materials and Methods

An Observational - cross sectional study was conducted on 90 osteoporotic patients age range 30-80 years in department of Physiology in collaboration with Orthopaedic OPD in KPCMCH, Kolkata .

Study Design: Observational and cross sectional study

Study Location: The study was carried out in the department of Physiology, in collaboration with Orthopaedic OPD in KPCMCH, Kolkata 32.

Study Population: The age group between 30 to 80 years of individuals visiting the Orthopedics’ Department

Study Duration: (July 2019 to September 2019)

Sample Size: 90 individuals.

Sample Size Calculation: By using the formula i.e $N = (Z^2pq/e^2)$, I was calculated my sample size..In this study my Sample Size is 90 which included in different cause and effect group.

Selection criteria of patients: Specific selection criteria include: Menopausal women, Geriatric age group of men, and associated illness like diabetes, thyroid, chronic malnutrition, Low physical activity, obesity, and smoker.

Inclusion criteria:

1. All consenting individuals visiting the Orthopaedics department having the age group between 30 to 80 years of individuals.
2. Specific inclusion criteria include: Menopausal women, Geriatric age group of men, and associated illness like diabetes, thyroid, and chronic malnutrition.

Exclusion criteria:

1. Autoimmune disease like: Systemic lupus erythematosus (SLE), Rheumatoid arthritis (RA) etc.
2. Corticosteroid therapy.
3. Malignancy.
4. Hypertension.
5. Neurodegenerative disease.

Procedure methodology:

After written informed consent was obtained, a well – designed questionnaire was used and following methodology was used to collect the data of required patients retrospectively. The study was conducted on different stages of stress and osteoporotic patients and protocol was approved by our *Human Ethical Committee (HEC)*. HAM D scale was used to assess the depression levels. Cortisol estimation was done from serum and BMD was measured by using DEXA. Statistical analysis amongst the parameters was also computed.

Technique:

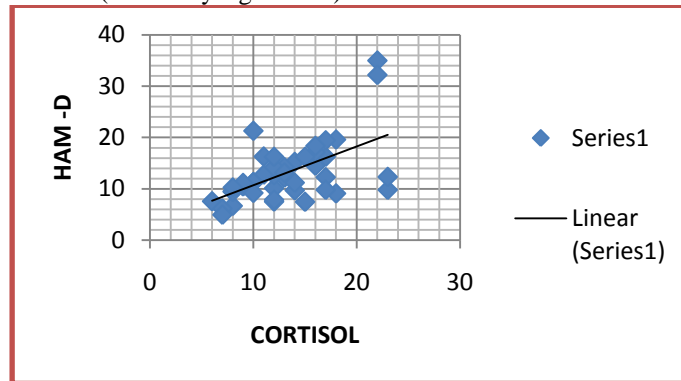
<i>Name of the parameters</i>	<i>Name of the instruments</i>	<i>Methods</i>
Historical records and Clinical scoring of depression	Not required any instrument	➤ Depression was determine by using Ham D scale ⁸
Hormonal estimation Cortisol	Chemiluminisence & ELISA (enzyme linked immunosorbent assay)	➤ Salivary cortisol was measured by ELISA method ⁹
Bone biomarker (BMD analysis)	DEXA(dual energy X-ray absorptiometry)	➤ The ‘gold standard’ method of BMD testing by dual X-ray absorptiometry (DEXA) ¹⁰

Statistical analysis:

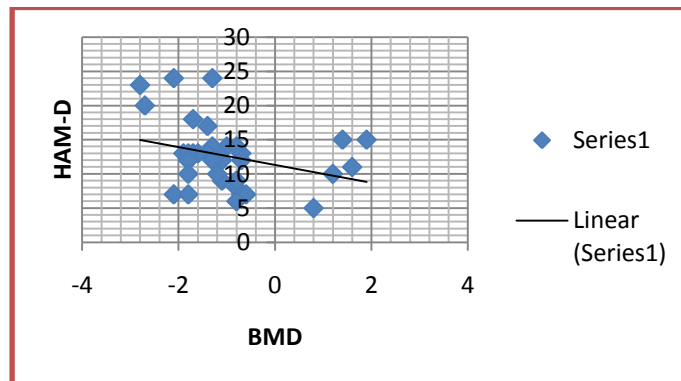
Statistical correlation was computed using MS Excel 2007 and SPSS 22 software. The level of P<0.05 was considered as the cutoff value or significance.

III. Result

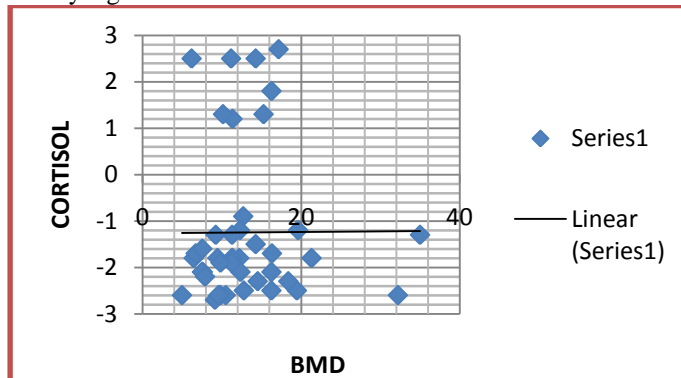
- The correlation between HAM-D score and serum cortisol showed an R value of 0.56(moderately positive correlation) and $P < 0.00001$ (extremely significant).



- The correlation between HAM-D and BMD showed $R = -0.259$ (moderately negative correlation) and $P < 0.05$ (significant).



- The correlation between serum cortisol and BMD showed a $R = -0.17$ (negligible correlation) and $P > 0.05$ which was not statistically significant.



IV. Discussion

Analysis of the Clinical Score of Depression and serum glucocorticoids level revealed a statistically significant positive correlation. Clinical score of Depression and BMD revealed statistically significant negative correlation. The correlation between serum glucocorticoids and BMD was found to be negative, but statistically insignificant.

V. Conclusion

Hence it is suggested that apart from glucocorticoids other factors may be involved in lowering BMD. Future research is required to study the effects of other endocrine and metabolic factors in osteoporosis patients associated with depression.

In conclusion, the clinical evaluation of subjects with idiopathic bone loss, especially premenopausal women and young/middle aged men should be also included for a proper assessment of varied parameters associated with depression and bone resorption.

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