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Effect of Sex Steroid Hormone (Estrogen) on Bone Mass Density in Men

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Abstract

Osteoporosis is a systemic and metabolic skeletal disease characterized by reduced bone mass .It is a growing health problem in men as well as women. The objective of this work is to demonstrate the role of sex steroid hormone, estrogen (E2), in maintaining bone mass. Spine bone mass density (BMD) was measured using Dual Energy X-ray Absorptiometry (DEXA) for (111) subjects and patients with osteoporosis and serum levels of estradiol were measured . The results show a highly significant($p<0.001$) correlation between serum level of estradiol and spine BMD in young , middle age , and elderly men .The present study concluded that estrogen is important in maintaining BMD in men .

تأثير هرمون الاستروجين على كثافة العظم لدى الرجال

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الملخص

هشاشة العظام مرض ايضي يتميز بانخفاض الكتلة العظمية ويعتبر من المشاكل الصحية المتزايدة عند الرجال . الهدف من هذا البحث لإثبات دور هرمون الاستروجين في المحافظة على الكتلة العظمية في أعمار مختلفة عند الرجال حيث كان عدد المشاركين بالبحث (111) تتراوح اعمارهم (30-**78**) سنة تم تصنيفهم بعد اجراء قياس الكتلة العظمية باستخدام تقنية الاشعة الثنائية بوحدة الهشاشة التابعة للعيادة الاستشارية في مستشفى ابن سينا والسلام التعليميتين في مدينة الموصل بالعراق الى (42) مريض في مجموعة المرضى بهشاشة العظام و (69) شخص في مجموعة السيطرة و تم سحب الدم لجميع المشاركين وثم قياس مستوى هرمون الاستروجين في مصل الدم وبعد اجراء التحليل الإحصائي لوحظ ان هناك انخفاض معنوي في مستوى هرمون الاستروجين مقارنة مع الأشخاص في مجموعة السيطرة ومن ذلك نستنتج ان لمستوى الاستروجين في مصل الدم دور كبير في المحافظة على الكتلة العظمية عند الرجال.

Introduction

Male osteoporosis has become recognized as an important clinical and public health problem. Estrogens are essential for bone maturation and mineralization in both men and women. Estrogens slow the rate of bone remodeling and protect against bone loss. Estrogens also exert effects on the lifespan of mature bone cells, proapoptotic effects on osteoclasts but anti-apoptotic effects on osteoblasts and osteocytes[1,2]. Hormonal changes are important factors for osteoporosis development in aging men .Recently, estrogen role in male bone homeostasis has been demonstrated through congenital estrogen deficiency description: estrogen resistance due to inactivating mutation in the estrogen alpha receptor gene [3,4] and aromatase (the enzyme that catalyzes androgens conversion into estrogens) deficiency [5]. In both cases, lack of estrogen activity was associated with osteoporosis or severe osteopenia, demonstrated by low BMD at lumbar and femoral sites [6].

Subjects and Methods

This study represents a case –control study. The total number of subjects included in this study is 111 adult men , their age ranged between (30-78) years. All of the subjects were free from secondary causes of osteoporosis Patients with chronic liver and renal disease, on Gn RH agonist for prostate cancer and on corticosteroids were excluded from the study then they were referred to measure BMD in DEXA unit In both, Al-Salaam and Ibn-Sina out patient clinic in Mosul city . DEXA scans of the AP lumbar spine is done by DEXA machine (HOLOGIC Discovery -W-,USA), bone mineral density (BMD) , defined bone mineral content (BMC) is divided by bone area , BMD is measured in g/cm2 or converted into values related to the average male peak bone mass or to the bone mass related to the patient's age. These are T scores
involve the following calculation[7]**:**

$$\textbf{T score} = \frac{\text{Patient's BMD – population peak BMD}}{\text{Standard Deviation (SD) of population peak BMD}}$$

According to WHO classification of T score in 1994 Patients with a T score of <2.6 SD were taken as osteoporotic, and those greater than 1 SD were considered control or normal [8]. Blood sample was drawn at morning between 9-11 AM from all participants in this study , complete separation of serum is done and Estradiol (E2) concentration in the serum was determined by enzyme Immunoassay (EIA),by using a kit supplied from (Bio Check), and measured by ELISA(FAX®2100 USA)[9] .

Results

After adjusted age .There is a highly significant ($p<0.001$) reduction in level of serum E2 in osteoporosis groups compared with control groups in young , middle aged and elderly men. In the present study, at age group (30-44) years the levels of serum E2 in control subjects is (53.08 pg/ml) which is significantly ($p<0.001$) higher than it's levels in osteoporotic patients (33.36 pg/ml . At the age of (45-59)years the levels of E2 decreases compared to age group (30-44) years

also the osteoporotic patients show significantly ($p<0.001$) lower levels of E2 (45.74 pg/ml) compared to their level in control subjects (27.43 pg/ml). At the age of ≥60 years, Subjects of the two groups (control, and osteoporotic) shows lower levels of serum E2 compared to the previous age groups (30-44) years and (45-59) years. At this age group (≥60)years , the level of serum E2 is significantly lower ($p<0.001$) in osteoporotic patients compared to control subjects as shown in (table 1) .In this study ,we confirmed strong relation between spine BMD and E2 levels in men as shown in (figures 1) and positive correlation between spine BMD and E2.

Table(1):- comparison between control and osteoporosis in different aged groups

Age groups (years)	Classes of spine T score	N	Spine BMD (mean ±SD)	Estradiol (mean ±SD)	P < value
30-44	Control	28	1.06 ± 0.14	53.08 ± 13.27	0.001
	osteoporosis	15	0.77 ± 0.05	27.37 ± 5.89	
45-59	Control	25	1.04 ± 0.11	45.74 ± 11.28	0.001
	osteoporosis	11	0.75 ± 0.06	27.43 ± 4.53	
≥60	Control	16	1.03 ± 0.13	44.13 ± 11.42	0.001
	Osteoporosis	16	0.74 ± 0.06	23.19 ± 5.55	

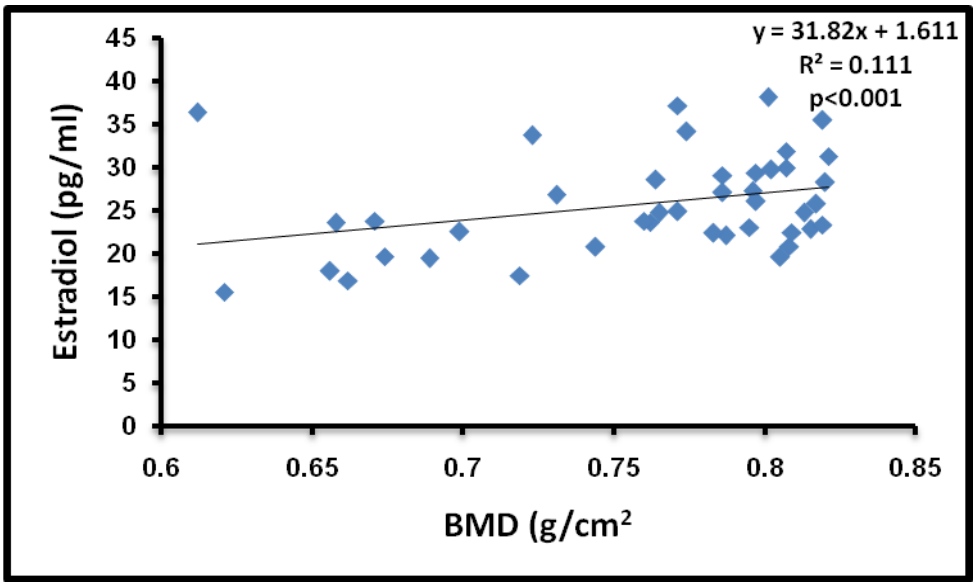

Fig. (1):- Effect of serum estrogen on spine BMD in osteoporotic patients

Discussion

Estrogen deficiency accelerates bone loss in men, estrogen deficiency accelerates the normal turnover of bone tissue, but the net activity of bone resorbing cells (osteoclasts) is greater than that of bone forming cells (osteoblasts). This gives rise to thinning of the cortices of bones, thinning of trabecular bone and loss of trabecular elements, The architectural changes weaken bone disproportionately compared to the loss of skeletal mass [(10)]. In this study, Osteoporotic patients with low BMD have lower E2 compared with control subjects with normal BMD which have higher serum E2 ,estrogen are an important to maintenance bone mass in men and estrogen deficiency in ageing men lead to bone loss and decrease BMD as shown in (table 1) this results agree with Ohlsson et al .(2009)[(11)] and with Clapauch et al (2009)[(12)] who reported in their study in healthy middle aged men that E2 levels were lower in osteoporotic subjects (36.69 ± 1.59 pg/mL) compared to normal BMD men (42.26 ± 2.26 pg/mL). In this study, there is a highly significant ($p<0.001$) positive effect of serum level of E2 on spine BMD in young age men as shown in(table 1) , this results agree with Venkat et al (2008) [(13)]. In this study, the present study confirmed strong relation between spine BMD and E2 levels in men as shown in (figures 1) and positive correlation between spine BMD and E2. This results agree with Khosla et al(1998)[(14)]showed in their study that total E2 levels were positively and significantly correlated with BMD at lumbar spine in all age groups (young, middle and old men). In this study, we can confirm that estrogen has important role in male bone homeostasis and estrogen receptor in bone (ERα activation resulted both in preserved thickness and trabecular number , E deficiency is a major cause of bone loss . many causes lead to estrogen deficiency in men: congenital estrogen deficiency, estrogen resistance due to inactivating mutation in the estrogen alpha receptor gene, aromatase (the enzyme that catalyzes androgens conversion into estrogens) deficiency, androgen deficiency while Center *et al.*(1999) [(15)], concluded in their study ,the relationships between E2 and BMD at the spine was not significant in men. Ilangovan et al (2006) [(16)] didn't found any significant difference between osteoporotic and normal old men in serum level of E2 the mean and SD in normal and osteoporotic subjects respectively were (28.4 ± 2 and 26.9 ± 2.1 (pg/ml)).

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