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Connection of Depression and Bone Loss in Perimenopausal and Postmenopausal Women

Ivana Ljubičić Bistrović[1], Ika Rončević-Gržeta[1], Željka Crnčević-Orlić[2], Tanja Frančišković[1], Rudolf Ljubičić[3], Anamarija Orlić[4] and Miljenko Kapović[5]

[1] University of Rijeka, Rijeka University Hospital Centre, Psychiatric Clinic, Rijeka, Croatia
[2] University of Rijeka, Rijeka University Hospital Centre, Clinic for Internal Medicine, Rijeka, Croatia
[3] University of Zagreb, »Sestre Milosrdnice« University Hospital Centre, Psychiatric Clinic, Zagreb, Croatia
[4] University of Rijeka, Faculty of Philosophy, Rijeka, Croatia
[5] University of Rijeka, School of Medicine, Department for Biology and Medical Genetics, Rijeka, Croatia

A B S T R A C T

Depression has been implicated as a possible risk factor for low bone mineral density (BMD). However, there is still no solid evidence that could connect these two different illnesses. This research examined the association between self-reported depression and low BMD in perimenopausal and postmenopausal women. This research screened 130 female patients who were 44 to 72 years old and registered at the densitometry clinic of KBC Rijeka during a three month period. Densitometry was performed in order to establish their BMD and according to the results two groups of participants were formed: normal BMD – 38 participants with normal BMD at hip and spine and reduced BMD – 75 participants with lower BMD at hip and spine. Depression was assessed using Beck depression inventory. Both groups of participants were compared regarding their depression scores. There were no significant differences between the groups with normal and reduced BMD regarding mean age, age of menopause, length of menopause and number of births ($p=0.001$). Difference regarding depressiveness between the two groups was not significant ($t=0.73$; $p=0.468$). Also, there were no differences between the groups regarding the frequency of certain levels of depression. ($\chi^2=2.27$; $p=0.52$). Results of this research suggest that self-reported depression is not associated with low BMD in perimenopausal and postmenopausal women.

Key words: *bone mineral density, depression, perimenopause, postmenopause*

Introduction

Osteoporosis is a disease characterized by low bone mineral density (BMD). In addition, many patients exhibit ostopenia, reduced bone mineral density (BMD) level that is indicative of being at high risk for osteoporosis. BMD has been shown to be a risk for fracture[1] and patients are usually not aware of having thinning bones until they experience vertebral, hip, or other types of fracture. Recent years have seen increase of incidence of osteoporosis, which can be attributed to the overall aging of general population. Osteoporosis can be divided into primary and secondary, based on its etiology and pathogenesis. Primary osteoporosis includes involution osteoporosis (postmenopausal osteoporosis and osteoporosis of older age), along with idiopathic osteoporosis. Menopause and older age are the most significant factors contributing to the development of primary osteoporosis. Most severe loss of bone mass in postmenopausal osteoporosis happens in spongy bones, but in senile osteoporosis in cortical bones. Secondary osteoporosis occurs secondary to other diseases and disorders. Most frequent causes of secondary osteoporosis are endocrine disorders (hypogonadism, hyperthyreosis, hyperparathyreosis, diabetes mellitus, and Cushing syndrome), hematologic illnesses, effects of certain medications (corticosteroids)[2,3], chronic illnesses (rheumatic illnesses, some gastrointestinal disorders, malignancies), chronic alcohol abuse, stress and according to some researches, depression[4].

Depression has been implicated as a possible risk factor for low BMD[5]. However, researches regarding depression and BMD are inconsistent as some studies showed a relationship between depression and BMD and others did not[6,7].

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Research among perimenopausal women in Australia showed a connection between higher self-report of depression and lower hip BMD[8].

According to some researches, depression shows altered regulation of hypothalamus-pituitary-adrenal gland cortex axis, along with inhibited growth hormone release and decreased functioning of thyroid gland, gonads and immunologic system. Perimenopausal women that suffer from depression show greater bone mass loss, that could be a consequence of altered pituitary – adrenal gland cortex axis and its effects on bone turnover. In older age, cortisol secretion is increased during evening and night time, although secretion of cortisol during the day is normal. It has been shown that this disturbance in the daily cycle of cortisol secretion can alter bone mass density[9,10]. Other researches confirm existence of several direct pathways through which depression or dysthymia could lower proximal femoral BMD. For example, persistently elevated plasma cortisol levels have been associated with clinical depression[11] and also with low BMD[12].

Based on clinical experience of endocrinologists it has been noted that people suffering from osteoporosis are more often depressive, compared to other patients. Therefore, psychiatrists and endocrinologists from Clinical Hospital Centre in Rijeka performed screening of patients referred to densitometric scans in order to objectify depressive symptoms. The aim of this research was to compare patients with normal and lowered bone mass in regard to their depressive symptoms.

Patients and Methods

Patients

This research screened 130 patients that registered at the densitometry clinic of KBC Rijeka during a three month period. Further selection of patients was performed on the basis of gender and age and research included 44 to 72 year old female patients. Exclusion criteria were: established clinical depression, cognitive impairments, severe physical illnesses, decreased eyesight and any other physical and psychical state that could influence patient's capability to participate in this research or lower the reliability of obtained data.

17 patients out of 130 that were screened were excluded from the research. 11 due to age requirements (either older than 72 or younger than 44) and 6 due to failure to complete given questionnaires. There were no patients excluded according to exclusion criteria.

Patients that satisfied inclusion criteria and accepted to participate in this research were informed about the research. They also signed informed consent about participating in the research and completed given questionnaires, as well as performed densitometric scans. The whole procedure took roughly 40 minutes to complete.

Methods

Instruments used in this research were: general questionnaire, Beck depression inventory (BDI)[13] and densitometric scans.

General questionnaire

This questionnaire was used in order to acquire general demographic data such as: age, height, weight, length of menopause, number of childbirths and smoking habit.

Beck depression inventory (BDI)

Depressive symptoms were assessed according to the Beck depression inventory (BDI)[13]. This inventory is a 21-item self-report instrument intended to assess the existence and severity of symptoms of depression. Individual questions of the BDI asses mood, pessimism, sense of failure, self-dissatisfaction, guilt, punishment, self-dislike, self-accusation, suicidal ideas, crying, irritability, social withdrawal, body image, work difficulties, insomnia, fatigue, appetite, weight loss, bodily preoccupation, and loss of libido.

Every question of the BDI can be answered according to the severity of problems, from 0 to 3. Results were interpreted as follows: 0–11 – no clinical depression, 12–19 – mild depression, 20–26 – moderate depression and over 26 – severe depression.

Densitometry

This method was used to asses BMD (posteroanterior scans of vertebrae and left hip) with a DXA method on a Hologic Delphy machine. Accuracy of the method used for the area of lumbal spine is 1%, maximal up to 3%, and for the hip area 1–3%, maximal up to 5%[14–16]. Osteoporosis is defined by the World Health Organization (WHO) in women as a bone mineral density 2.5 standard deviations below peak bone mass (20-year-old healthy female average) as measured by DXA. Severe osteoporosis is when T-value is 2,5 standard deviations below peak bone mass and one or more pathological fractures are present. Osteopenia is a condition with bone mineral density between 1 and 2,5 standard deviations below peak bone mass[17,18].

Based on densitometry results, participants were divided into two groups: normal BMD – 38 participants that do not have lower spine and hip BMD and reduced BMD – 75 participants with lower spine or/and hip BMD. Those two groups were compared in regard to their depression scores and symptoms.

Statistical analysis

Basic descriptive statistical parameters were analyzed – arithmetic means and standard deviation for continuing variables, frequency and percentage of certain cases for categorical variables. Differences between groups regarding continuing variables were calculated using a t-test for independent samples and for variables expressed in frequencies chi-square test. Pearson's correlation coefficient was used to research possible connections between variables.

Results

Normal BMD group consisting of 38 participants was compared to the reduced BMD group consisting of 75 pa-

TABLE 1
GENERAL SAMPLE CHARACTERISTICS

Group	Normal BMD N=38	t, χ^2/p	Reduced BMD N=75
Age			
mean	57.87	t=1.087	59.21
standard deviation	7.200	0.279	5.653
Age of menopause			
mean	49.03	t=0.090	48.93
standard deviation	5.451	0.929	5.100
Length of menopause			
mean	10.40	t=0.048	10.47
standard deviation	6.524	0.962	6.608
Height			
mean	166.789	t=3.237	163.2
standard deviation	6.609	0.002	4.897
Weight			
mean	77.816	t=5.050	66.82
standard deviation	11.282	<0.001	10.74
BMI			
mean	28.00	t=3.987	25.04
standard deviation	4.064	<0.001	3.549
Number of births	0 – 4 (10.5%) 1 – 11 (28.9%) ≥2 – 23 (60.5%)	χ^2=0.534 0.766	0 – 13 (12.0%) 1 – 37 (34.7%) ≥2 – 63 (63.5%)v
Non-smoker	31 (81.6%)	χ^2=0.077 0.781	58 (77.3%)
Smoker	7 (18.4%)		17 (22.7%)

TABLE 2
NUMBER AND PERCENTAGE OF PARTICIPANTS WITH NORMAL AND REDUCED BMD REGARDING DEPRESSIVE SYMPTOMS

Group	Without depression	Depression	χ^2 / P
	N (%)	N (%)	
Normal BMD	24 (63.8)	14 (36.8)	0.00 / 1.00
Reduced BMD	47 (62.7)	28 (37.3)	

tients. There were no significant differences between the two groups regarding mean age, age of menopause, length of menopause, number of births, number of smokers (Table 1). Normal BMD group was significantly taller (t= 3.24; p= 0.002), heavier (t= 5.05; p<0.001) and had a higher BMI (t= 03.99; p< 0.001).

Results of this research showed that 14 participants from the normal BMD group and 28 from the reduced BMD group were depressed. Two groups did not significantly differ regarding depressive symptoms (Table 2) (t= 0.73; p= 0.468).

There were no differences between the two groups in regard to frequency of certain levels of depression (Table 3) (χ^2= 2.27; p= 0.52).

In the normal BMD group age, height, weight, BMI, age of menopause, length of menopause, number of births, number of smokers did not significantly correlate with depression (p>0.05). In the reduced BMD groups age, height, BMI, age of menopause, length of menopause, number of births, number of smokers did not significantly correlate with depression (p>0.05). While weight was negatively correlated with depression (r = –0.24; p= 0.037).

Discussion

Our research showed no statistically significant differences between groups with normal and reduced BMD in regard to depression (Table 2).

Connection between depression and osteoporosis is still an insufficiently researched area of medicine and results thus far are inconsistent. Petronijević and associates found that premenopausal women with depression have significantly lower BMD due to stimulated bone cell metabolism with predomination of osteoresorption processes, mostly due to decreased physical activity of patients suffering from depression[19]. Michelson and associates measured bone mineral density at the hip, spine, and radius and compared 24 women with past or current depression with 24 normal women, and suggested that past or current depression in women is associated with decreased bone mineral density[11].

Contrary to these reports Yazici and Ozsoy concluded that major depression is not associated with any alteration in BMD[20,21].

Some studies showed that mostly premenopausal women suffering from depression are at greater risk of de-

TABLE 3
DIFFERENCES BETWEEN GROUPS WITH NORMAL AND REDUCED BMD REGARDING SEVERITY OF DEPRESSION

Group	Without depression	Depression			χ^2 / P
		Mild	Moderate	Heavy	
	N (%)	N (%)	N (%)	N (%)	
Normal BMD	24 (63.2)	11 (28.9)	3 (7.9)	0 (0)	2.269 / 0.519
Reduced BMD	47 (62.7)	18 (24.0)	6 (8.0)	4 (5.3)	

veloping osteoporosis, while that risk was not greater in perimenopausal and postmenopausal women. Our research confirmed these findings. Altindag and associates stated that depression should be considered as a risk factor for osteoporosis in premenopausal women[22]. Spangler in the study of postmenopausal women observed minimal association between depressive symptoms and 3-year changes in BMD or fracture risk[23].

Whole series of articles and researches were performed in order to clarify possible connection of depression and reduced bone mineral density. However, there is still no solid evidence that could connect these two different illnesses. One of the possible reasons is that all these researches were very different in their design. Several researches were performed on a larger number of participants and in postmenopausal women. Robbins and associates conducted a research on a random sample of 1,566 Medicare enrollees, women and men, age 65 and older and found a significant association between BMD and depressive symptoms[24]. Laudisio and associates, in a population based study of 306 men with a mean age of 75, suggested that assessment for depression should be performed in older men with diagnosis of osteoporosis[25]. Other authors performed their research on smaller samples of participants and in younger population. Kavuncu and associates matched 42 healthy women with 42 patients diagnosed with depression and concluded that low BMD was not a prominent feature of premenopausal woman with mild depression, even though an increase in bone resorption was found[26]. Eskandari and associates reported baseline BMD measurements in 89 premenopausal women with MDD and 44 healthy controls and concluded that low BMD is more prevalent in premenopausal women with MDD[27].

Participants in this research assessed their depressiveness through a self-report questionnaire for depression, but have never been diagnosed or treated for depression. Majority of research conducted until now compared clinically depressed patients suffering from major depressive disorder and healthy volunteers[28,29].

We used Beck Depression Inventory in order to evaluate the severity of depression and did not find any correlation between depression and BMD. On the other hand, Coelho and associates performed a research among 40–80 year old women and established that women with osteoporosis have significantly higher levels of depressive symptoms[30].

Some of the reasons which could clarify results of this research are its limitations: relatively small sample of participants, women included were in perimenopause as well as postmenopause (we can speculate that results would be different if this research included only women in perimenopause or postmenopause), grade of BMD was not measured and due to that fact it was not possible to perform certain correlation analysis. As no clinically depressed patients were enrolled in this research we expected, and results confirmed these expectations, that participants would be less frequently depressive or that their depression would be of lower intensity (Table 3).

Out of all the variables that were correlated to depressiveness, only weight in reduced BMD group was negatively correlated to depression.

In conclusion, women in perimenopause or postmenopause that do not suffer from clinical depression and have never been treated for depression do not share a connection between their depressiveness and reduced BMD.

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I. Ljubičić Bistrović

University of Rijeka, Rijeka University Hospital Centre, Psychiatric Clinic, Cambierieva 17/7, 51 000 Rijeka, Croatia
e-mail: ljubicic.ivana@yahoo.com

POVEZANOST DEPRESIJE I GUBITKA MINERALNE GUSTOĆE KOSTIJU U ŽENA U PERIMENOPAUZI I POSTMENOPAUZI

S A Ž E T A K

Depresija se smatra mogućim rizičnim čimbenikom za nisku mineralnu gustoću kostiju (BMD). No, još uvijek nema čvrstih dokaza koji bi povezivali ove dvije različite bolesti. Ovim istraživanjem se ispitivala povezanost između samoprijavljene depresije i niskog BMD u perimenopauzalnih i postmenopauzalnih žena. Ovo istraživanje je obuhvatilo 130 žena u dobi od 44 do 72 godine koje su se javile u denzitometrijski centar KBC-a Rijeka tijekom tromjesečnog perioda promatranja. Učinjena je denzitometrija kako bi se ustanovila mineralna gustoća kostiju te su po dobivenim rezultatima formirane dvije skupine ispitanica: one s normalnom mineralnom gustoćom kostiju – 38 ispitanica s normalnim BMD kuka i kralježnice i one sa sniženom mineralnom gustoćom kostiju – 75 ispitanica sa sniženim BMD kuka i kralježnice. Depresija je procjenjivana Beckovim samoprocjenskim upitnikom. Obje skupine su uspoređivane po rezultatima na navedenom upitniku. Nije bilo značajnih razlika između skupina s normalnim i sniženim BMD glede srednje dobi, dobi menopauze, trajanju menopauze i broja poroda (p=0,001). Razlika u depresivnosti između dvije skupine nije bila značajna (t=0,73; p=0,468). Nadalje, nisu ustanovljene razlike između skupina glede učestalosti određenih razina depresije (χ^2-test 2,27; p=0,52). Rezultati ovog istraživanja sugeriraju da samoprijavljena depresija nije povezana sa sniženom mineralnom gustoćom kostiju u perimenopauzalnih i postmenopauzalnih žena.