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ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2022;11(2):672-6

Does ABO blood type is a novel risk factor for osteoporosis or low bone density among postmenopausal women or not?

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Received 02 November 2021; Accepted 04 January 2022
Available online 14.03.2022 with doi: 10.5455/medscience.2021.11.362

Abstract

ABO blood types may cause a vulnerability to individuals for conditions such as malignancies or chronic diseases. However, the interaction of ABO blood types and osteoporosis is inexplicit. In this study, we focused on the role of ABO blood types on bone health by comparing bone mineral density (BMD), and the prevalence of low bone mass (LBM) and osteoporosis among postmenopausal women. Non-institutionalized postmenopausal women aged over 50 years were prospectively enrolled in the study following the measurement of BMD by dual-energy X-ray absorptiometry (DEXA). The prevalence of osteoporosis and LBM were interpreted according to T scores of either site. Self-reported blood types of participants were noted. The study included 220 postmenopausal women, and the median age of participants were 59 (11) years (min:50 years, and max:82 years). The mean BMD values at the lumbar spine, femoral total, and femoral neck of participants were 0.821±0.118 g/cm^2, 0.810±0.121 g/cm^2, and 0.716±0.112 g/cm^2, respectively. Both mean BMD and T scores of enrollees for either site were similar across blood types (p-value >0.05 for all). The prevalence of osteoporosis and LBM showed no significant association between blood groups (p=0.45, and p=0.226, respectively).The present study showed evidence of a similar BMD, the prevalence of LBM, and osteoporosis among postmenopausal women over 50 years regardless of ABO blood type.

Keywords: Osteoporosis, period, postmenopausal, ABO blood type

Introduction

Osteoporosis can be defined as the weakening of bones which increases the fragility and results in fractures that lead to an increase in morbidity and mortality [1]. In the 5th decade of life, the prevalence of osteoporosis is 6.8% among women and rises to 12.3%, 25.7%, and 34.9% in the following decades [2].

In addition, at least 49% of women suffer from low bone mass (LBM) regardless of age [2]. As a result of the bone mass decrease in postmenopausal women aged over 50 years, the prevalence of osteoporosis and osteoporosis-related comorbidities significantly increases. While approximately 50% of postmenopausal women suffered from osteoporosis-associated fracture during a lifetime, 15% of women experienced a hip fracture during the postmenopausal period [3]. Osteoporotic fractures, especially hip fractures, may lead to catastrophic results such as disability and chronic pain, deteriorated life quality, and the most importantly, increased mortality rate [4]. Therefore, in addition to the purpose of early diagnosis and treatment of osteoporotic patients, timely screening of individuals at high risk for osteoporosis, determination of independent risk factors, and prevention, if possible, should be aimed. Osteoporosis-associated risk factors were stated in the ten-year fracture risk model presented by World Health Organization (WHO) [5]. In addition, many other risk factors and clinical conditions associated with osteoporosis have been widely studied [6,7].

The genetically coded blood type of individuals defines by the glycosyltransferase enzymes synthesized by the Golgi apparatus of the erythrocytes. In addition, it has been shown that the existence or lack of the blood type antigens (Antigen A, Antigen B, Both,

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or None) may lead to a vulnerability to individuals for specific medical conditions [8,9]. In the current literature, the results of studies carried out to reveal the association of osteoporosis and ABO blood types are contradictory [8,10–12]. While some studies suggested that having other than O blood type is an independent risk factor for the development of osteoporosis [10–12], the research published by Seyfizadeh et al. reported that none of any ABO blood types had either negative or positive effect on the prevalence of osteoporosis [8].

In this current study, we evaluated the possible effects of ABO blood types on bone mineral density (BMD) of the lumbar spine and hip, and its association with the prevalence of LBM and osteoporosis in postmenopausal women over 50 years of age.

Materials and Methods

Study population and setting

This cross-sectional study was performed in a single center with a prospective enrollment of the enrollees. Non-institutionalized women aged 50 and over who undergo a BMD measurement of hip and lumbar spine by dual-energy x-ray absorptiometry (DEXA) were questioned for the existence of menopause, and the presence of a document showing their blood type. So, individuals in the postmenopausal period with documented blood type information were included in the study.

All participants were carefully assessed for osteoporosis-associated risk factors listed in the WHO fracture risk assessment tool (FRAX®) [5], including having alcohol three units or more per day, current smoking, diagnosis of rheumatoid arthritis, use of glucocorticoids, or having a disorder strongly associated with for secondary osteoporosis. We obtained informed consent from all participants.

Exclusion criteria were to have at least one current risk factor for osteoporosis listed in FRAX®, lack of knowledge or documentation of blood type, and intimidation of approving informed consent.

The local ethical committee approved the project with the number 2020/35-46418926, and we obtained informed consent for all attendants. The study protocol conforms to the ethical principles declared by both the Turkish Ministry of Health and Turkish Medicine and Medical Devices Agency Good Clinical Practices Guidelines, and also with the Helsinki Declaration of 1975, as revised in 1983.

Working protocol

We noted the blood type information of all participants. In addition to the blood type, we measured the height and weight of participants and calculated the body mass index (BMI) (kg/m^2) by dividing body weight by square of height.

We noted both T- and Z-scores of either site of the lumbar spine, femoral total, or femoral neck. To interpret the results of DEXA measurement and define osteoporosis and LBM, we used the WHO T-score definitions as follows: T-score of any three sites ≤ -2.5: osteoporosis, ≤ -1: LBM, and > -1: normal [13].

Statistical analysis

For statistical analysis, we used version 26.0 of Statistical Package for Social Sciences (SPSS) (Chicago, Illinois). The normality of distribution was tested by the Shapiro-Wilk test. For normally distributed continuous variables, the results were expressed as the mean and standard deviation (SD). Besides, the median and interquartile range (IQR) were given for skewed continuous variables. The categorical data were presented as absolute numbers and a percentage of the total. The Chi-Square test was used to compare categoric variables. The differences between the continuous variables in the ABO blood type groups were estimated by the One Way Anova test or Kruskal Wallis test according to the distribution of variables. The statistically significant p-value was accepted as < 0.05.

Results

The basic characteristics of the study population

A total of 220 outpatients were included in the study and the median age was 59 (11) years (min:50 years, and max:82 years). The basic characteristics of the study population were given in Table 1. Most of the patients have A blood type (n:93, 42.2%) and the age of participants did not reveal any significance among blood type groups (p= 0.952) (Table 1). The frequency of Rhesus (Rh) factor positives was also similar between all blood type groups (p=0.308) (Table 1).

The study group consists of slightly overweight patients with a BMI of 29.30 (5.06) kg/m^2, and it showed no difference across blood types (Table 1).

All the attendees were postmenopausal, and none of them has any risk factors for osteoporosis mentioned in FRAX® [5].

Table 1. Basic characteristics of the study population

	Total (n=220)	Blood Types				P
		O (n=80)	A (n=93)	B (n=29)	AB (n=18)	
Age (Years), median (IQR)	59 (11)	59 (12)	60 (13)	59 (11)	59 (4)	0.952
Height (cm), mean (SD)	158.39 (5.85)	158.86 (6.54)	158.26 (5.50)	159.31 (4.86)	155.44 (5.27)	0.119
Weight (kg), mean (SD)	73.51 (13.34)	74.20 (13.30)	73.97 (13.64)	72.24 (11.99)	70.17 (14.49)	0.636
BMI (kg/m^2), mean (SD)	29.30 (5.06)	29.38 (4.84)	29.57 (5.47)	28.47 (4.57)	28.87 (4.80)	0.756
Rh Positive, n (%)	193 (87.7)	62 (28.2%)	80 (36.4)	21 (9.5)	15 (6.8)	0.308

IQR: interquartile range; SD: standard deviation; BMI: Body Mass Index; Rh: Rhesus factor

The comparison of BMD results and prevalence of LBM and osteoporosis

The mean BMD values at the lumbar spine, femoral total, and femoral neck of all participants were 0.821±0.118 g/cm^2, 0.810±0.121 g/cm^2, and 0.716±0.112 g/cm^2, respectively. The comparison of the mean BMD values for either site revealed that the mean BMD values at the lumbar spine (p=0.933), femoral total (p=0.694), and femoral neck (p=0.750) were similar for each blood type (Table 2). Similarly, as given in Table 2, the mean T and Z scores of enrollees showed no difference among any blood types (p value > 0.05 for all).

The prevalence of LBM and osteoporosis for all blood type groups were given in Table 3. The prevalence of osteoporosis (T-score of <-2.5 at one of three sites), showed no significant association between blood groups in postmenopausal women (p=0.459). Also, the frequency of LBM (T-score ≤-1.0 at one of three sites), was similar between all blood type groups (p=0.226). Besides, all BMD values, frequency of osteoporosis, and LBM were similar between O blood type and non-O blood type groups (p value > 0.05 for all) (Table 4).

Table 2. Comparisons of bone density, T and Z scores at three sites

	Total (n=220)	Blood Types				P
		O (n=80)	A (n=93)	B (n=29)	AB (n=18)	
BMD (g/cm^2), mean (SD)						
Lumbar Total	0.821 (0.118)	0.816 (0.126)	0.827 (0.118)	0.817 (0.105)	0.821 (0.110)	0.933
Femoral Total	0.810 (0.121)	0.802 (0.115)	0.809 (0.129)	0.827 (0.121)	0.830 (0.111)	0.694
Femoral Neck	0.716 (0.112)	0.712 (0.108)	0.721 (0.119)	0.727 (0.112)	0.694 (0.103)	0.750
T Score, mean (SD)						
Lumbar	-2.06 (1.07)	-2.12 (1.14)	-2.01 (1.07)	-2.11 (0.99)	-2.06 (0.99)	0.915
Femoral Total	-1.02 (1.02)	-1.14 (0.96)	-0.99 (1.13)	-0.81 (0.87)	-0.91 (0.92)	0.453
Femoral Neck	-1.17 (1.02)	-1.24 (0.97)	-1.14 (1.07)	-1.03 (0.96)	-1.19 (1.16)	0.806
Z Score, mean (SD)						
Lumbar	-0.56 (1.14)	-0.63 (1.24)	-0.50 (1.03)	-0.65 (1.22)	-0.41 (1.19)	0.798
Femoral Total	-0.01 (0.97)	-0.15 (0.87)	0.04 (1.07)	0.17 (1.00)	0.35 (.86)	0.421
Femoral Neck	0.14 (0.97)	0.07 (0.92)	0.23 (1.00)	0.21 (1.05)	-0.12 (0.88)	0.449

BMD:Bone mineral density; SD: standard deviation; p values <0.05 accepted as significant

Table 3. Frequency of osteoporosis and low bone mass among blood types

	Blood Types				P
	O (n=80)	A (n=93)	B (n=29)	AB (n=18)	
Osteoporosis*, n (%)					
Either Site	38 (17.3)	34 (15.5)	12 (5.5)	9 (4.1)	0.459
Lumbar Total	37 (16.8)	31 (14.1)	12 (5.5)	8 (3.6)	0.362
Femoral Total	5 (2.3)	7 (3.2)	1 (0.5)	1 (0.5)	0.886
Femoral Neck	9 (4.1)	8 (3.6)	1 (0.5)	2 (0.9)	0.640
Low Bone Mass, n (%)**					
Either Site	32 (14.5)	51 (23.2)	14 (6.4)	7 (3.2)	0.226
Lumbar Total	28 (12.7)	44 (20.0)	13 (5.9)	6 (2.7)	0.346
Femoral Total	20 (9.1)	19 (8.6)	2 (0.9)	3 (1.4)	0.212
Femoral Neck	20 (9.1)	29 (13.2)	6 (2.7)	5 (2.3)	0.668

*Osteoporosis= T-score ≤ -2.5; **Low bone mass= T-score ≤ -1.0 (Patients with osteoporosis were excluded); %: Given as percentage of the total

Table 4. Comparison of bone density, frequency of osteoporosis and low bone mass between O blood type and non-O blood type

	Blood Types		P
	O (n=80)	Non – O (n=140)	
BMD (g/cm²), mean (SD)			
Lumbar Total	0.816 (0.126)	0.824 (0.113)	0.617
Femoral Total	0.802 (0.115)	0.815 (0.125)	0.413
Femoral Neck	0.712 (0.108)	0.718 (0.115)	0.692
Osteoporosis*, n (%)			
Either Site	38 (17.3)	55 (25.0)	0.235
Lumbar Total	37 (16.8)	51 (23.2)	0.153
Femoral Total	5 (2.3)	9 (4.1)	0.958
Femoral Neck	9 (4.1)	11 (5.0)	0.400
Low Bone Mass, n (%)**			
Either Site	32 (14.5)	72 (32.7)	0.102
Lumbar Total	28 (12.7)	63 (28.6)	0.147
Femoral Total	20 (9.1)	24 (10.9)	0.161
Femoral Neck	20 (9.1)	40 (18.2)	0.567

BMD: Bone mineral density; SD: standard deviation *Osteoporosis= T-score ≤ -2.5; **Low bone mass= T-score ≤ -1.0 (Patients with osteoporosis were excluded); %: Given as percentage of the total

Discussion

In this study, we evaluated the association of BMD values, the prevalence of LBM, and osteoporosis with ABO blood types among postmenopausal women aged 50 years and over to specify whether being in any specific blood type is independently increasing the risk of osteoporosis. However, the results revealed that none of the blood types shows an association with the mean BMD value of any site or the prevalence of either LBM or osteoporosis.

Several studies conducted to reveal the association of ABO blood types and chronic conditions or malignancies clarified that some particular blood types may play a crucial effect in the incidence and outcomes of some chronic conditions such as diabetes mellitus and chronic heart failure [14–16] and malignancies [17,18]. Also, in a study from Africa, authors have reported that having AB blood type is associated with higher glucose levels than the individuals with A, B, or O blood types [19].

The results of studies conducted to reveal the effect of ABO blood types in the current literature are limited and the data they provided are contradictory. Similar to the results of our study, one of the most recent research on this field have reported that neither ABO blood types nor Rh-positive and Rh-negative blood types had any association with the prevalence of osteoporosis among the elderly population [8].On the contrary, Lu and Li from China concluded that elders other than O blood types have increased risk for the progression and the severity of osteoporosis [20].

On the other hand, unlike the results of our study, some studies specifically conducted with postmenopausal women have reported that ABO blood type status has a significant association with the prevalence of osteoporosis [11,12]. Maninder Kaur from North India has reported that women with O blood type significantly higher BMD as compared to those with non-O blood group [12], and Choi and Pai from South Korea revealed that postmenopausal women in the O blood type group have a significantly lower frequency of osteoporosis [11]. However, we did not demonstrate such a difference among postmenopausal Turkish women in our study.

This study has some limitations. First, we did not include the patients that have any risk factors which have a strong effect on the development of osteoporosis that may cause a smaller prevalence of LBM and osteoporosis. Second, we have a lack of information about the comorbid diseases of participants. Third, the pattern of our study was cross-sectional design with prospective enrollment and does not have such power as a prospective follow-up study.

Conclusion

In conclusion, the present study showed evidence of the similar value of BMD, the prevalence of LBM, and osteoporosis among postmenopausal women over 50 years. Furthermore, none of any blood types revealed a significant difference in the prevalence of either low BMD, LBM, or osteoporosis. Based on findings in our study and current literature, it would be feasible to conduct further prospective studies with a larger cohort to reach a distinct statement.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
The institutional ethical committee approved the project with the number 2020/35-46418926, and we obtained informed consent for all attendants. We mentioned this in the materials and method section.

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