

The Impact of Osteoporosis and Thoracic Kyphosis on the Parameters of Quality of Life in Postmenopausal Women

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Original Article

Abstract

Introduction: Osteoporosis is caused by a loss in the bone mass and the subsequent complications decrease quality of life (QOL) of the patients. This study is performed aiming to determine the effects of osteoporosis and thoracic kyphosis on the parameters of QOL in postmenopausal women.

Materials and Methods: This was a case-control study in which 53 postmenopausal women participated according to the T-score and thoracic kyphosis and were divided into four groups. Then, QOL and also different fields were compared among the groups using the 36-Item Short Form Health Survey questionnaire (SF-36). The data analysis was performed using SPSS software.

Results: According to the results, the impact of osteoporosis on total scores of QOL was not significant ($P = 0.783$). In the areas of QOL, there was a significant difference only in the area of pain ($P = 0.030$). However, there was a significant difference regarding the effect of postural kyphosis on the total score of QOL ($P = 0.021$). In addition, in the fields of mental health problems, energy, mental feelings, and general health status, the differences were significant ($P < 0.050$).

Conclusion: Comparing the two factors affecting QOL in postmenopausal women (osteoporosis and postural kyphosis), it was revealed that the increased thoracic kyphosis had a more remarkable role in lowering the total score of QOL. Therefore, it is necessary to correct this situation in postmenopausal women.

Keywords: Osteoporosis, Thoracic kyphosis, Quality of life, Postmenopausal women

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Introduction

Around the age of 50, women experience a sudden drop in sex hormones, which can lead to menopause. Today, changes in lifespan and increased life expectancy have led women to spend more years in the postmenopausal period. Therefore, the problems and complications caused by it have become more tangible, requiring more attention (1). Following menopause, women develop problems, including osteoporosis due to hormonal changes. Osteoporosis is the most common metabolic bone disease that is associated with decreased bone mass and bone quality (2). The importance of osteoporosis is associated with an increased risk of fractures. These fractures, in addition to various complications and illnesses and the imposition of heavy medical costs on society,

even lead to death in some cases. The risk of dying from the complications of osteoporosis during a woman's lifetime is equal to the risk of dying from breast cancer and four times the risk of dying from endometrial cancer (3). Osteoporotic fractures are also a major cause of hospital costs and disabilities in many parts of the world (4).

With age or following osteoporosis, women experience spinal changes, with the most common change being postural kyphosis, which affects postural balance, gait, performance, and postural sway (5). Complications of kyphosis include increased pain prevalence, decreased muscle strength, decreased vertebral density, decreased height, decreased rib mobility, and even decreased respiratory function. Additionally, the curved posture

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can change the movement strategies and impaired balance due to bringing the center of gravity (COG) closer to the stability limits (6,7). On the other hand, increasing the kyphosis angle reduces the range of motion (ROM) of spinal extensions (8) and has a definite effect on physical performance, the ability to perform daily activities of life, and ultimately, the quality of life (QOL) (9).

Addressing the issue of menopause and the subsequent problems is very important from various individual and social aspects. Because on the one hand it helps to solve women's problems and on the other hand, considering the importance of the role of women as the emotional and psychological axis of the family and the active workforce in society, paying attention to their QOL and solving their physical, mental, and social problems will be very effective definitely in promoting family health. Moreover, preventing the late complications of menopause can help countries, especially developing countries, to have a healthy population. Achieving these goals can be fulfilled by planning and trying to provide effective solutions to adapt to the issues of this period. Therefore, this study is conducted with the aim to investigate and compare the effect of osteoporosis and thoracic kyphosis on QOL of postmenopausal women.

Materials and Methods

This was a case-control study performed on 53 volunteer postmenopausal women aged 48 to 70 years. The subjects were selected from among the postmenopausal women referred to the bone mineral density (BMD) department of Baqiyatallah Hospital, Tehran, Iran. These individuals were introduced to participate in the project after undergoing a clinical examination by a rheumatologist, if they were eligible. Estimation of the sample size was based on the average sample in the study by Miyakoshi et al. (10) with 95% confidence and 80% test power. Given the calculations, the number of subjects was estimated to be about 10 in each group.

The study inclusion criteria were women aged 48 to 70 years old, passage of at least one year after menopause, non-participation in regular sports activities at least one year before the start of the study (regular exercise means at least 30 minutes a day as 3 days a week), lack of a history of fractures due to osteoporosis, no secondary osteoporosis, lack of balance problems, no history of hormone therapy for at least the last six months, no report of muscle, neurological, metabolic, and neuromuscular diseases [diabetes mellitus (DM), neuropathy], chronic trunk orthopedic disorders [low back pain (LBP)], lack of known congenital anomalies

in the spine and congenital scoliosis, lack of underlying diseases such as rheumatic, pulmonary, fibromyalgia diseases, and cancer.

In case of change in the participants' conditions, unwillingness to continue cooperation, and failure to complete the desired tests, they were excluded from the study. The participants entered the testing phase after completing the informed consent form. It should be noted that all stages of the experiment were performed in the biomechanics laboratory of Tarbiat Modares University, Tehran, Iran. Furthermore, the use of the patients' information in this research project was approved by the Medical Ethics Committee of Tarbiat Modares University.

In the present study, the samples were divided into four groups based on BMD using the T-score criterion and the status of the thoracic vertebrae curvature as well as by measuring the angle of curvature, which included "osteoporotic with normal postural kyphosis (osteoporotic-normal kyphosis), osteoporotic with increased postural kyphosis (osteoporotic-hyperkyphosis), non-osteoporotic with normal postural kyphosis (non-osteoporotic-normal kyphosis), and non-osteoporotic with increased postural kyphosis (osteoporotic-hyperkyphosis). The T-score was equal to or less than 2.5 and equal to or greater than -2.5 for osteoporotic and non-osteoporotic individuals, respectively (11).

At the beginning of the session, height was measured in meters and weight in kilograms, and then the body mass index (BMI) was calculated. Thoracic kyphosis was then measured using a flexible ruler. The measuring range for thoracic kyphosis was the seventh cervical vertebra (C7) and the twelfth thoracic vertebra (T12). The subjects first stood in the curved spine position with the shoulder-width apart feet. The spinous process (SP) of C7 is the most prominent SP, and by counting down, T12 could be identified. Besides, by determining the location of the twelfth rib and extending it to the vertebrae, the location of T12 was evaluated again. After these vertebrae were marked, the subjects stood in a normal, comfortable position, with the feet bare and shoulder-width apart. Then one end of the ruler was placed on C7 and the other end on T12, and by placing the ruler completely on the arch, the curvature of the thoracic region was transferred to the ruler. After placing the ruler on the paper, the thoracic kyphosis angle was calculated using Equation 1 (12), where, θ , L, and H were the angle of curvature, the distance between the two beginning and end points of the curve, and its perpendicular bisector, respectively.

The measurement was performed twice with a

break of one minute and the average of two values was taken.

$$\theta = 4 \left[\text{ARCtag} \left(\frac{2H}{L} \right) \right] \quad \text{Equation 1}$$

The validity and reproducibility of using a flexible ruler in the measurement of thoracic kyphosis have been proven in previous studies (13,14).

QOL was assessed using the 36-Item Short Form Health Survey questionnaire (SF-36). This self-report scale, which is mainly used to measure QOL and health, was first developed by Ware and Sherbourne (15). The 36-SF questionnaire has 36 items and 8 sections. 2 items of this scale are about general health status, each of which is assigned a score from 0 to 100, with a higher score indicating better general health, 10 items are related to activity limitations, with each item given a score of 0, 50, or 100 based on the answer given, and a higher score indicates less limitation in daily activities. Moreover, 4 items of the scale are about physical health problems, with each of which given a score from 0 to 100, and a higher score indicates a better state of physical health, 3 items are related to mental health problems, each of which is assigned a score from 0 to 100, and higher scores indicate less restriction in daily activities due to mental health problems. 2 items are in the field of social activities, with each assigned a score from 0 to 100, and a higher score indicates less disruption in social communication due to the physical and mental health of individuals, 2 items are about the amount of physical pain and limitation in activities due to physical pain, each of which is given a score from 0 to 100, and a higher score indicates less pain. 9 items are about emotional energy and feelings, each of which is given a score from 0 to 100, and a higher score indicates higher energy and better feelings. Finally, 4 items are about general health status, each of which is assigned a score from 0 to 100, and a higher score indicates a better and more positive

attitude towards health status.

The accuracy and validity of the 36-SF scale have been confirmed in the study carried out by Darbani and Turkman, which was also conducted on postmenopausal women (16). The Persian version of this tool had previously been standardized by Montazeri et al. in Iranian society, with the results showing that the Persian version of the 36-SF questionnaire had the necessary validity and reliability; in such a way that the internal consistency analysis and Cronbach's alpha coefficient of the whole questionnaire were reported to be 0.93 for the Iranian community (17). In the present study, the reliability of each area of the scale on individuals was examined using the Cronbach's alpha coefficient. Accordingly, the coefficients in the areas of health status components, activity limitation, physical health status, mental health status, social activity, pain, energy and emotional feelings, and general health status were respectively 0.63, 0.68, 0.73, 0.77, 0.68, 0.80, 0.78, and 0.66, which indicates relatively good levels of reliability.

Mean and standard deviation (SD) of the data were reported using descriptive statistics. The normal distribution of the data was investigated using the Shapiro-Wilk test and parametric tests were employed to compare the data. One-way analysis of variance (ANOVA) test was utilized to compare anthropometric variables and two-way ANOVA test was applied to evaluate the effect of osteoporosis and postural kyphosis on the score of QOL and its different areas. Finally, the data were analyzed in SPSS software (version 22, IBM Corporation, Armonk, NY, USA). $P < 0.05$ was considered as the significance level.

Results

The demographic characteristics of the participants are listed in table 1. There was no significant difference among the four groups divided according to BMD and thoracic kyphosis in the variables of age, height, weight, and BMI ($P > 0.050$).

Table 1. Mean anthropometric variables in the studied groups

Group	Variable	Non-osteoporotic-normal kyphosis (n = 16)	Non-osteoporotic-hyperkyphosis (n = 10)	Osteoporotic-normal kyphosis (n = 17)	Osteoporotic-hyperkyphosis (n = 10)	P-value
	Age (year)	55.44 ± 4.99	55.63 ± 2.72	57.69 ± 4.71	56.38 ± 4.50	0.528
	Height (cm)	157.75 ± 6.37	156.63 ± 5.85	155.56 ± 6.33	156.00 ± 3.27	0.751
	Weight (kg)	67.33 ± 6.74	68.71 ± 6.02	64.80 ± 6.57	67.22 ± 8.45	0.601
	BMI (kg/m ²)	27.60 ± 3.12	28.88 ± 2.48	26.33 ± 2.12	27.61 ± 3.44	0.211
	History of menopause (years)	7.18 ± 5.43	5.06 ± 3.29	10.34 ± 6.22	11.44 ± 6.48	0.060
	Menopausal age (year)	48.06 ± 3.78	50.56 ± 2.71	48.23 ± 3.32	46.50 ± 4.95	0.194

Data are reported as mean ± SD. BMI: Body mass index

Table 2. Effect of osteoporosis and postural kyphosis of participants on the total score of quality of life (QOL) and its different areas

Areas of QOL	Osteoporosis	Postural kyphosis	Postural kyphosis × Osteoporosis
General health status	0.130	0.180	0.473
Activity restriction	0.942	0.105	0.775
Physical health problems	0.376	0.345	0.628
Mental health problems	0.621	0.007*	0.909
Social activities	0.715	0.070	0.833
Pain	0.020*	0.866	0.308
Energy and spiritual feelings	0.773	0.001*	0.526
General health status	0.834	0.025*	0.860
Total QOL score	0.783	0.021*	0.582

QOL: Quality of life; *P < 0.050

The results of the two-way ANOVA test employed to evaluate the effect of two independent variables of osteoporosis and postural kyphosis of the postmenopausal women on 9 QOL indicators are presented in table 2. The results indicated the effect of osteoporosis and postural kyphosis on the score of QOL and some of its different areas. Pain was the only factor in the area of QOL in which osteoporosis was significant ($P \leq 0.020$). This means that postmenopausal women with osteoporosis experienced more physical pain, regardless of whether or not they had a postural kyphosis. Although the mean scores of other QOL areas were lower in women with osteoporosis compared to the non-osteoporotic women, no significant difference was observed in any of them.

Examination of the effect of the kyphosis variable on QOL revealed that the posture factor had a greater effect on QOL of the subjects compared to osteoporosis. In other words, the decrease in the score of the QOL areas due to the postural kyphosis was more effective than the decrease in BMD. This score in postmenopausal women with kyphosis, despite having or lacking osteoporosis, showed a greater decrease even in non-significant areas by 10 to 17%. This index was significant in other areas of QOL such as mental health problems, energy and emotional feelings, and general health status.

Discussion

In the present study, the effect of osteoporosis and postural kyphosis on QOL and its various areas was investigated. Many studies have been accomplished on the QOL of postmenopausal women. Some studies have also examined the QOL of women with osteoporosis, but so far no study has compared the effect of osteoporosis and postural kyphosis on QOL.

In assessing the reliability of the 36-SF questionnaire using the Cronbach's alpha coefficient on postmenopausal women, most of the studied areas,

especially significant cases, had a good degree of reliability. Therefore, by ensuring the reliability of the results of the areas, they can be discussed. The results of the present study indicated that the score of all areas of QOL of postmenopausal women with osteoporosis was impaired and it was lower compared to the menopausal women without osteoporosis. It should be noted that according to the scoring standard in the 36-SF questionnaire, a lower score in these women indicates a lower QOL. Only in the area of pain, a significant difference was observed, indicating that the group with osteoporosis experienced more pain compared to the non-osteoporotic group. Although the overall QOL score was reported to be lower in osteoporotic women than in non-osteoporotic women, this difference was not significant.

There was no significant difference between the two patient and non-patient groups in the areas of general health status, activity limitation, physical health problems, mental health problems, social activities, and energy and emotional feelings. The reason for the absence of such a difference can be attributed to the asymptomatic nature of the disease. The results of studies have shown that osteoporosis manifests itself in various forms, including skeletal fractures, kyphosis, and pain in the bones. Even in some women, there may be no external symptoms of the disease, and for this reason, some women are unaware of their disease, which is due to the asymptomatic nature of reduced BMD (18). Therefore, it seems that unawareness of the disease, regardless of its adverse and irreversible complications and consequences, causes women to not experience changes in their daily activities, which can lead to accidents and, ultimately, fractures. Osteoporosis is a multidimensional systemic disease that can affect different areas of life (19). Martin et al. claimed that the decline in QOL in women with osteoporosis may be due to fear of future fractures or because they feel they need to make lifestyle changes

to prevent possible future fractures (18).

The findings comparing the effect of postural kyphosis on QOL in postmenopausal women suggested that the total QOL score in women with hyperkyphosis was significantly lower than that of women with normal kyphosis regardless of having or not having osteoporosis. The mean score of women with hyperkyphosis in all areas of QOL was lower than that of the women with normal kyphosis. This difference was significant in the areas of mental health problems, energy and emotional feelings, and general health status, and there was no significance difference between the two groups of women with hyper kyphosis and normal kyphosis in other areas. These results show that the QOL of the women with hyper kyphosis decreases compared to women with normal kyphosis. Increased kyphosis can affect QOL, which is a multidimensional concept, by affecting the individual's balance, strength, performance, and gait. More importantly, increasing the angle of kyphosis is associated with a change in appearance in the person, which has a huge impact on his self-confidence. Back pain and interscapular pain also occur following an increase in kyphosis. The combination of these factors can even cause depression and severely affect QOL (20). The results of some studies have reported the effect of vertebral fractures on reduced QOL. Of course, in the present study, since no radiographs were taken from the subjects, the QOL decline could not be attributed to the vertebral fractures, but in general, there is a view that the decline in QOL in postmenopausal women cannot only be related to the number of vertebral fractures, but is also affected by micro-fractures, muscle imbalances, muscle and ligament irritation, the position of the intervertebral discs, ROM of the joints, and other factors (21,22). Ross et al. believe that height reduction relative to the age of 25 years is a more effective measure of QOL compared to the number of vertebral fractures in these patients (23). On the other hand, De Smet et al. stated that it is true that the size of kyphosis is strongly correlated with the number of vertebral fractures, but significant kyphosis is also seen in patients without reduced vertebral height or vertebral fractures, and it is the rate of kyphosis that affects disability and QOL (24). Consistent with this study, Miyakoshi et al. found in their study that in all three types of kyphotic malformations (Round back, Hollow round back, and Kyphosis whole), the QOL score was significantly lower than in healthy individuals (25), which was in agreement with the results of the study by De Smet et al. (24). In contrast, Ettinger et al. reported no effect of the kyphosis level on pain and disability in their

study of postmenopausal women aged 65 to 91 years (26). It should be noted that the results of the aforementioned study are not comparable with those of the present study due to the different population in terms of age group.

Limitations

Some researchers believe that vertebral fractures are a factor affecting QOL, and in the present study, the presence and number of vertebral fractures in the subjects was not evaluated due to the fact that taking radiographs without rational justification is not morally acceptable; this was one of the limitations of the present study.

Recommendations

In the present study, the 36-SF scale was used, which is the only localized questionnaire in Persian in this field, and its target group is not specific to people with osteoporosis. It is recommended to use questionnaires such as Menopause-specific Quality of Life Questionnaire (MENQOL) and Qualeffo-41 (after localization), which is for postmenopausal women.

Conclusion

The findings of the present study suggested that although the total score of QOL and its various areas was lower in women with osteoporosis compared to the non-osteoporotic women, this difference was only significant in the field of pain. Regarding the effect of posture, the total score of QOL and its different areas was lower in women with hyperkyphosis in comparison to women with normal kyphosis. Furthermore, this difference was significant in the areas of mental health problems, energy and emotional feelings, and general health status. Postural disorders seem to play a greater role in reducing the QOL of postmenopausal women relative to osteoporosis, and changes in their QOL are more affected by their posture than by osteoporosis. Therefore, in this regard, attention to postural kyphosis in postmenopausal women and its correction should be a priority in rehabilitation programs.

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Authors' Contribution

Zeinab Mohammadjannataj: Study implementation, data collection, data analysis, writing the first draft of the manuscript; Sedigheh Kahriz: study design, data analysis, editing and approval of the draft and final writing of the manuscript; Noshin Bayat: study design, data analysis, editing and approval of the draft and final writing of the manuscript.

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Conflict of Interest

None of the authors have any conflict of interest in the present study.

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