



Original Article

The Differences of Osteoporosis Awareness and its Association with 10-Year Fracture Risks Between Female Breast Cancer Survivors Before and After Menopause Age[☆]



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SUMMARY

Objective: To compare the osteoporosis awareness and its association with 10-year fracture risks between young and old breast cancer survivors.

Methods: During the 2011 *Pink October* campaign hosted by the Taiwan Breast Cancer Alliance and the Taiwanese Osteoporosis Association, questionnaires on osteoporosis awareness and FRAX variables were distributed. Data from participants aged 40 years and older ($n = 807$) were analyzed. Comparisons were made between those aged below and above 50 years, and among different tertiles of predicted fracture risk groups.

Results: Mean age was 56.0 ± 7.7 years. Only half (52.7%) showed a high level of osteoporosis awareness. Older survivors were more likely to exhibit higher awareness levels (55.0% vs. 44.8%; $p < 0.05$). Moreover, osteoporosis awareness increased among higher predicted 10-year major osteoporosis fracture risk groups. Older survivors (age ≥ 50 years) also had a higher body mass index, higher prevalence of secondary osteoporosis, and higher predicted 10-year fracture risk ($p < 0.05$).

Conclusion: Osteoporosis awareness levels were higher among older and higher fracture risk breast cancer survivors. Educational program and osteoporosis prevention strategies may start with younger and lower fracture risk breast cancer survivors to increase the awareness in order to reduce under-management of osteoporosis.

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1. Introduction

Breast cancer is the most common cancer among women worldwide. Advances in both cytotoxic chemotherapy and endocrine therapy have reduced breast cancer mortality¹. However, chemoendocrine therapy has some negative effects on bone health, including increased risk of fracture^{2,3}. Although effective treatment and prevention methods of osteoporosis exist, under-detection and

under-treatment are common in the general population and breast cancer patients⁴. Poor awareness and knowledge of osteoporosis may be one of the reason for under-management of osteoporosis⁵. Past studies have shown relatively low levels of osteoporosis awareness within the general population^{6–10}. However, studies on osteoporosis awareness among breast cancer patients are limited. The association of osteoporosis awareness between younger and older population was inconclusive in the previous studies^{6–11}.

One previous study showed that people with a previous osteoporotic fracture had a better awareness about the osteoporosis¹¹. In the same study, the awareness was not associated with the severity of osteoporosis. It is worthwhile to evaluate the association between osteoporosis awareness and the severity of fracture risks in order to establish effective educational program to increase awareness and prevent under-treatment. To the best of our

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knowledge, no study has yet evaluated osteoporosis awareness and its association with fracture risks among breast cancer survivors. Besides, there is no standard guideline to define high fracture risks patients in breast cancer survivors¹².

To advance the research on osteoporosis awareness, the objectives of this study are twofold: (1) to evaluate the difference of osteoporosis awareness between female breast cancer survivors before and after menopause age participating in a large educational campaign; and (2) to explore the relationship between osteoporosis awareness and levels of predicted fracture risk groups by applying the Fracture Risk Assessment Tool (FRAX) algorithm¹³.

2. Methods

2.1. Participants

The 2011 *Pink October* campaign was held on October 30 in Taipei City Hall Plaza. The campaign was sponsored by the Merck, Sharp & Dohme (MSD) pharmaceutical company, Taiwan, and designed by the Taiwanese Osteoporosis Association (TOA) and the Taiwan Breast Cancer Alliance (TBCA). In brief, the purpose of the annual Pink October campaign is to increase awareness about fighting and preventing breast cancer. The 2011 event theme was "Osteoporosis awareness and prevention among breast cancer survivors." More than 1000 female breast cancer survivors attended the event, and 942 anonymously completed and returned the study questionnaires. Of these, 807 aged 40 years and older (the lower age limit for FRAX application) were included in the final analysis.

2.2. Measurements

We designed a self-reported questionnaire with three major components. The first part included three osteoporosis awareness questions. Question 1: Do you know that the mortality rate of osteoporosis is similar to that of stage 4 breast cancer? Question 2: Do you know that breast cancer treatment accelerates bone loss? Question 3: Do you know that 41% of Taiwanese women older than 50 years have osteoporosis? We defined the level of osteoporosis awareness by number of correct answers to the three proposed questions. We created an awareness level index by assigning a 1-point value to a "yes" answer for each question. A score ≥ 2 indicated a high level of awareness on osteoporosis. The three questions developed by experts were designed to find out that if participants know important concept of osteoporosis and its association to breast cancer. Therefore, those who knew more correct answers to the questions were considered to have higher osteoporosis awareness in this population. The second part of the questionnaire (Question 4) involved the plan that the participants would implement if they knew they were at high risk for osteoporosis or fractures. The potential plans included the following: (1) visiting a physician; (2) other: please specify. The last section of the questionnaire involved the 11 variables required for FRAX use including age, sex, weight, height, previous fracture, hip fracture history of parents, smoking status, steroid use, rheumatoid arthritis history, secondary osteoporosis history, and current alcohol intake. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Instructions were given before participants filling the questionnaire by the trained volunteers from the TBCA. They also helped the participants fill out the questionnaires when necessary. The TOA acquired data from MSD in order to perform data analysis independently. Because our noninterventional study was carried out in public and the information was collected anonymously, without personal identifiers, informed consent was not needed. We also applied for a certificate of exempt review from

the international review board in National Taiwan University Hospital. Prediction of the 10-year major osteoporotic fracture and hip fracture risk by FRAX was derived from the Taiwanese calculator. The high risk cutoff points were defined as a 10-year major osteoporotic fracture probability $\geq 20\%$ or hip fracture risk probability $\geq 3\%$, as suggested by Taiwanese Osteoporosis Clinical Treatment Guidelines¹⁴.

2.3. Statistical analyses

The participants were further divided into two groups, using age 50 years (a proxy for menopausal status) as the cutoff point. Student *t* test was used to compare the mean values of the younger and older participants. Percentages and categorical variables were tested with the χ^2 test and Fisher exact test where appropriate. We divided the predicted fracture risks into tertiles. Logistic regression model with adjustment for age and trend test were applied to explore the relationship between the tertiles of fracture risks and osteoporosis awareness derived from three questions. Further, the association between age groups (divided into groups by decades) and fracture risk was plotted. All statistical analyses were performed using SAS statistical software, version 9.1 (SAS Institute, Inc., Cary, NC, USA).

3. Results

Baseline characteristics of participants are shown in Table 1. The mean age was 56.0 ± 7.7 years. The first, second, and third questions on osteoporosis awareness were answered "yes" by 30.7%, 68.9%, and 56.3% of participants, respectively. Nearly 92% of participants stated that they would visit a physician if they were at high-risk for fracture. The proportion of older survivors exhibiting a high awareness level about osteoporosis was greater than that of younger survivors (55.0% vs. 44.8%; $p < 0.05$). Risk factors that were present in $\geq 10\%$ of the participants included previous fracture, parent hip fracture, glucocorticoid use, and secondary osteoporosis. According to the FRAX model, 19.6% (hip fracture risk) and 5.8% (major osteoporotic fracture) of the participants were considered at high-risk for fracture. Compared to younger survivors (age < 50 years), older survivors were also shorter, and had higher BMI and secondary osteoporosis prevalence (all $p < 0.05$).

The relationship between osteoporosis awareness level and the severity of 10-year major osteoporotic fracture risk probability (divided into tertiles) is presented in Table 2. Except for Question 3, statistically significant trends of increased osteoporosis awareness among participants at higher risk for major osteoporotic fracture were found after adjusting for age. For instance, compared to the low-risk group, participants in the middle- and high-risk groups were 1.76 (1.14–2.70) and 2.20 (1.29–3.75) times more likely to answer "yes" to Question 1, respectively. Similar trend between osteoporosis awareness and tertile of predicted 10-year hip fracture risk was found. However, the trend was not statistically significant (data not shown).

Figure 1 shows the distribution of mean 10-year major osteoporotic fracture risk and hip fracture risk probabilities with age. We found a steadily increased mean fracture risk for each decade from age 40 years, until it reached a plateau at age 80 years.

4. Discussion

In the present study, we found a consistently low level of osteoporosis awareness among breast cancer survivors, with higher levels of awareness observed among older participants. Osteoporosis awareness increased in the groups with higher predicted 10-year major osteoporotic fracture risk by FRAX. In general, the

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