ORIGINAL ARTICLE

Oman Medical Journal [2017], Vol. 32, No. 6: 455-460

Characteristics and Correlates of Woman Eligible for Targeted Screening Mammography in Oman

Mahmood Masud Al Awfi* and Obaid Said Al-Hubaishi

Department of Surgery, Oman Medical Speciality Board, Muscat, Oman

ARTICLE INFO

Article history:
Received: 27 May 2017
Accepted: 16 August 2017

Online:
DOI 10.5001/omj.2017.88

Keywords:
Breast Cancer; Risk Factors; Mammography; Oman.

ABSTRACT

Objectives: We sought to determine the characteristics of women eligible for a high-yield screening mammography program in Oman. ***Methods***: We conducted a retrospective review of women who underwent breast cancer screening at the Oman Cancer Association from 22 December 2009 to 6 February 2011. Women with a Breast Imaging Reporting and Data System (BI-RADS) score of 4–5 were compared with those with a score of 1–3 based on well-known breast cancer risk factors using the case-control approach analysis. ***Results:*** A BI-RADS score of 4–5 was found in 16.2% of women screened for breast cancer. A higher likelihood of a BI-RADS score of 4 or 5 was observed among women who did not breastfeed (odds ratio (OR) = 2.564; 95% confidence interval (CI): 1.690, 3.890), had their first pregnancy at an older age (OR = 1.062; 95% CI: 1.041, 1.083), used oral contraceptives (OR = 1.397; 95% CI: 1.008, 1.938), and those who reported a positive family history of malignancies (OR = 1.633; 95% CI: 1.285, 2.076). A BI-RADS score of 4 or 5 was significantly less likely in women with a higher number of full-term pregnancies (OR = 0.919; 95% CI: 0.890, 0.948). BI-RADS 4–5 were independently predicted in women with a lower number of full-term pregnancies, did not breastfeed, used oral contraceptives, and who had a positive family history of malignancies. These variables explained 84.0% of the variation in mammogram results. ***Conclusions:*** In the absence of a national screening program for breast cancer, the high-risk approach for screening should be considered. Women with the above characteristics should be identified and motivated to seek mammogram regularly to warrant a better outcome.

The change in the socioeconomic conditions of the Omani population between 1990 and 2005 has altered the profile of diseases. In 2005, noncommunicable diseases accounted for more than 75% of disease burden. Malignant neoplasm is of major public health concern as it is the second causes of mortality and the third cause of disability-adjusted life years lost.[1]

In 2012, the worldwide incidence of breast cancer among women was 25.1%. Global estimates indicate that breast cancer is the most common cause of cancer mortality and accounts for 14.7% of cancer deaths among women. In Oman, breast cancer was found to be the most common type of cancer among women, and its incidence accounted for 28.8% in 2012 with a mortality rate of 18.4%.[2]

Despite the extensive research that has been conducted on breast cancer, the cause is not yet known. Previous studies pointed to the role of genetic, hormonal, and environmental factors either individually or collectively in increasing the risk of breast cancer.[3–5] Knowledge of risk factors contributing to the occurrence of breast cancer is indispensable for disease prevention. This knowledge is also of particular importance in identifying women eligible for screening.

Screening for breast cancer is based on the lead time; the time between the first possible detection and the usual time of diagnosis.[6] The early detection of breast cancer while the tumor is still confined to the breast tissue followed by excision with or without adjuvant therapy is associated with a substantial reduction in mortality and considerable improvement in quality of life.[6] Despite these facts, reports from the World Health Organization indicate that less than a quarter of eligible women consider mammography.[7]

The Oman Cancer Association (OCA) is a nongovernmental, nonprofit organization located in Muscat. It plays a pivotal role raising public awareness about the values of screening and the importance

*Corresponding author: ✉mahmood.alawfi@gmail.com

of early detection. The association was officially established in April 2004 as the first patient advocacy group in Oman aiming at cancer prevention. The initial focus of the association was to raise public awareness of the early presentation of different types of cancer through outreach community-based programs. Specialized services, namely clinical breast examination and mammogram services coupled with patient's counseling, were launched in December 2009.

The mobile breast cancer screening unit provides a free outreach screening service targeting women above the age of 40 in different regions of the country in conjunction with health centers. This age group was similar to that recommended by the American Cancer Society for average-risk women.[8] This program is an opportunistic screening program entirely based on women's own drive. Although the OCA initiative was noble, the resources and capabilities of the association cannot accommodate the whole country. Therefore, a more targeted screening program needs to be established through a high-risk strategy approach.

The concept of "high-risk strategy" screening entails the screening of women with one or more known leading risk factors for breast cancer. The high-risk strategy has the advantage of optimizing the use of screening services by increasing the likelihood of detecting breast cancer. This study aims to determine the characteristics of women eligible for screening to establish a high-yield screening mammography program in Oman.

METHODS

The electronic records of the OCA were reviewed retrospectively. All women who underwent screening mammography between 22 December 2009 to 6 February 2011 were included. Relevant information was retrieved and transferred manually into an electronic database created for this purpose using the Epi-Info™ software version 3.3.2 (CDC, Atlanta, Georgia).

Information retrieved was via a form that the women completed before undergoing screening. These were: personal data including women's identification number, place of residence, nationality, age, and marital status; family history of any type of malignancies; mammography results; and obstetric and gynecologic history namely: age at menarche, age at first pregnancy, number of full-term pregnancies, oral contraceptives, history of breastfeeding, hysterectomy and oophorectomy.

The mammogram was interpreted during the screening by senior radiologists using the Breast Imaging-Reporting and Data System (BI-RADS). BI-RADS is a standardized breast imaging findings terminology, report organization, assessment structure, and a classification system for mammography published and trademarked by the American College of Radiology.[9] The mammography results were not reinterpreted for the study, as the data available was consistent with the study design.

Data was analyzed using SPSS Statistics (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.). Checking for data entry error was done by frequency distribution and cross tabulation. Data were analyzed using the case-control approach analysis. Cases represented women with BI-RADS categories 4 and 5. Controls represented women with BI-RADS categories 1, 2, and 3. Because of missing information in almost all variables, only valid cases in each variable were considered resulting in a nonuniform total. The chi-square and *t*-test were used to test the difference between both groups of women in the collected variables. Univariate and multivariate logistic regression analysis were performed to identify the predictors of BI-RADS 4–5 based on the odds ratio (OR) and 95% confidence interval (CI). The significance of the obtained results was set at 5%.

The ethical review committees of Sultan Qaboos University and the OCA approved the study. Information was retrieved using a unique identifier and used only for scientific purpose to protect patients' confidentiality.

RESULTS

Between 22 December 2009 and 6 February 2011, 2 418 women were screened for breast cancer. The largest proportions of women screened were from the Muscat governorate (45.5%) and Al Batinah region (26.0%) followed by Al Dakhiliyah (15.6%). Lower proportions were from Al Sharqiyah (4.4%), Al Dhahirah (4.4%), Dhofar (2.7%), and Al Buraimi (1.1%).

Nearly three-quarters of screened women were in the 35–45 year old and 45–55 age groups (28.7% and 47.8%, respectively). A BI-RADS score of 4

Table 1: Age and marital status of women in relation to mammography results.

Age and marital status	BI-RADS score		Test of significance *p*-value
	1–3	4–5	
Age	n = 1 975	n = 383	
Mean ± SD, years	49.3±7.7	48.6±6.9	t = 2.149
Min–Max, years	32–86	34–70	$p = 0.032$
Marital status	n = 2 003	n = 385	
Never married, n (%)	9 (0.4)	5 (1.3)	$X^2_1 = 3.997$
Ever married, n (%)	1 994 (99.5)	380 (98.7)	$p = 0.046$

BI-RADS: Breast Imaging-Reporting and Data System; SD: standard deviation.

or 5 was ascertained among 16.2% of screened women. The mean age of women with BI-RADS 4–5 (48.6±6.9 years) was significantly lower than those with BI-RADS 1–3 (49.3±7.7 years) where $p = 0.032$. Almost all women were ever married (99.5%). A significantly higher percentage of women with BI-RADS 4–5 were never married (1.2% compared to 0.4%; $p = 0.046$) [Table 1].

The mean age of menarche was nearly 14 years among screened women with no significant difference

Table 2: Past obstetric and gynecologic history in relation to mammogram results.

History	Mammogram results, BI-RADS score		Test of significance *p*-value
	1–3	4–5	
Age of menarche	**n = 1 782**	**n = 336**	
Mean ± SD, years	13.6 ± 1.5	13.5 ± 1.6	t = 0.760
Min–Max	9–29	9–24	$p = 0.448$
Age of first pregnancy	**n = 1 814**	**n = 344**	
Mean ± SD, years	18.2 ± 4.7	20.0 ± 5.9	t = 5.249
Min–Max	11–46	12–58	$p < 0.001$
Number of full-term pregnancies	**n = 1 896**	**n = 352**	
Mean ± SD	8.0 ± 3.6	6.9 ± 3.8	t = 5.355
Min–Max	1–20	1–18	$p < 0.001$
Breastfeeding, n (%)	**n = 1 958**	**n = 373**	
No	76 (3.8)	35 (9.3)	$X^2_1 = 20.913$
Yes	1 882 (96.1)	338 (90.6)	$p < 0.001$
History of hysterectomy, n (%)	**n = 2 001**	**n = 393**	
No	1 832 (91.5)	357 (90.8)	$X^2_1 = 0.214$
Yes	169 (8.4)	36 (9.1)	$p = 0.644$
History of oophorectomy, n (%)	**n = 1 999**	**n = 392**	
No	1 917 (95.8)	380 (96.9)	$X^2_1 = 0.940$
Yes	82 (4.1)	12 (3.0)	$p = 0.332$
Contraceptives use, n (%)	**n = 1 997**	**n = 392**	
No	1 800 (90.1)	340 (86.7)	$X^2_1 = 4.058$
Yes	197 (9.8)	52 (13.2)	$p = 0.044$
Estrogen use, n (%)	**n = 1 995**	**n = 392**	
No	1 954 (97.9)	387 (98.7)	$X^2_1 = 1.054$
Yes	41 (2.0)	5 (1.2)	$p = 0.305$
Progesterone use, n (%)	**n = 1 993**	**n = 392**	
No	1 958 (98.2)	388 (98.9)	$X^2_1 = 1.102$
Yes	35 (1.7)	4 (1.0)	$p = 0.294$
Infertility treatment, n (%)	**n = 1 997**	**n = 391**	
No	1 991 (99.6)	389 (99.4)	$X^2_1 = 0.436$
Yes	6 (0.3)	2 (0.5)	$p = 0.509$

BI-RADS: Breast Imaging-Reporting and Data System; SD: standard deviation.

Table 3: Reported breast symptoms in relation to mammogram results.

Breast symptom	Mammogram results, BI-RADS score				X^2_1 *p*-value
	1–3		4–5		
	n	%	n	%	
Breast pain and/or discharge	**n = 1995**		**n = 393**		
No	1784	88.4	346	89.0	0.652
Yes	211	10.5	47	11.9	$p = 0.420$
Lump felt	**n = 1992**		**n = 393**		
No	1973	99.0	385	97.9	3.432
Yes	19	0.9	8	2.0	$p = 0.064$
Use of implants	**n = 2005**		**n = 391**		
No	1999	99.7	390	99.7	
Yes	6	0.2	1	0.2	$p = 1.000^{\dagger}$
Previous breast surgery	**n = 2004**		**n = 391**		
No	1902	94.9	365	93.3	1.573
Yes	102	5.0	26	6.6	$p = 0.210$

BI-RADS: Breast Imaging-Reporting and Data System; †p-value calculated from Fischer's exact test.

in relation to mammography results ($p = 0.448$). Compared to women with BI-RADS 1–3, those with BI-RADS 4–5 had their first pregnancy at a significantly older age (20.0±5.9 and 18.2±4.7, respectively, $p < 0.001$) and had a significantly lower number of full-term pregnancies (6.9±3.8 and 8.0±3.6, respectively, $p < 0.001$). No significant differences were observed between mammography results and history of hysterectomy or oophorectomy. Very few women did not breastfeed (4.7%); however, this proportion was significantly higher among those with BI-RADS 4–5 (9.3% and 3.8%, respectively, $p < 0.001$). A significantly higher percentage of women with BI-RADS 4–5 reported the use of oral contraceptives (13.2%) compared to those with BI-RADS 1–3 (9.8%) where $p = 0.044$. In contrast, nearly equal percentages of women in the two groups reported the use of estrogen ($p = 0.305$), and progesterone ($p = 0.294$). Only eight women reported treatment for infertility with no significant difference between those with BI-RADS 4–5 and BI-RADS 1–3 ($p = 0.509$) [Table 2].

No statistically significant differences were observed between women with a BI-RADS score of 4 or 5 and scores of 1, 2, and 3 in breast pain and/or discharge ($p = 0.420$) as well as breast lump ($p = 0.064$). Similarly, an equal percentage of women in the two groups reported the use of breast implants (Fischer's exact = 1.00) and a history of breast surgery ($p = 0.210$) [Table 3].

Almost one-third of women with BI-RADS 4–5 (30.5%) reported a family history of any type of cancer compared to 21.2% of those with a score of 1–3. This difference was statistically significant ($p < 0.001$) [Table 4].

Table 4: Family history of malignancies in relation to mammography results.

History of malignancy	Mammogram results, BI-RADS score				X^2_1 *p*-value
	1–3		4–5		
	n	%	n	%	
Family history of any malignancies	**n = 2004**		**n = 393**		
No	1579	78.7	273	69.4	16.270
Yes	425	21.2	120	30.5	$p < 0.001$
Relation of member affected	**n = 399**		**n = 114**		
Immediate relative	244	61.1	73	64.0	0.312
Distant relative	155	38.8	41	35.9	$p = 0.576$

BI-RADS: Breast Imaging-Reporting and Data System.

Table 5: Risk factors associated with a BI-RADS score of 4 or 5.

Risk factors	OR	95% CI
Older age	0.984	0.970, 0.999
Never married	2.915	1.072, 8.746
Older age at first pregnancy	1.062	1.041, 1.083
Greater number of full-term pregnancies	0.919	0.890, 0.948
No breastfeeding	2.564	1.690, 3.890
Oral contraceptive use	1.397	1.008, 1.938
Family history of any malignancies	1.633	1.285, 2.076

BI-RADS: Breast Imaging-Reporting and Data System; OR: odds ratio; CI: confidence interval.

Table 6: Independent predictors of a BI-RADS score of 4 or 5.

Independent predictors	Adjusted OR	95% CI
Greater number of full-term pregnancies	0.935	0.907, 0.964
No breastfeeding	1.918	1.221, 3.011
Oral contraceptive use	1.455	1.037, 2.045
Family history of any malignancies	1.559	1.210, 2.008

BI-RADS: Breast Imaging-Reporting and Data System; OR: odds ratio; CI: confidence interval.

The results of the univariate logistic regression analysis are presented in Table 5. An increase in women's age and in the number of full-term pregnancies were associated with a significantly lower risk of BI-RADS 4–5. In contrast, a score BI-RADS 4–5 was more likely among women who were never married, had their first pregnancy at an older age, never breastfed, used oral contraceptives, and those with family history of any type of cancer. The step-wise multivariate logistic regression analysis revealed that BI-RADS 4–5 is independently predicted by lower number of full-term pregnancies, lack of breastfeeding practice, use of oral contraceptives, and a positive family history of any malignancies. These four variables explain 84.0% of the variation in mammography results [Table 6].

DISCUSSION

In nearly 14 months the OCA delivered free screening services for 2418 women in different regions of Oman. The monthly number of women screened showed fluctuated during this period as it was linked to scheduled outreach activities. The fact that 45.5% of screened women were from Muscat indicates that the coverage outside the capital city and in remote areas was low.

Our study sample showed that women were considered for a screening mammogram as early as 32 years of age and those with a BI-RADS score of 4–5 were significantly younger than those with a score of 1–3. However, the significant contribution of women's age was eliminated when reproductive attributes were considered.

Our study, as well as others,[10–13] has pointed to the role of late first pregnancy,[10,11] lower parity and number of full-term pregnancies,[12,13] and lack of breastfeeding [10,13] in increasing the risk of breast cancer. Russo et al,[12] attributed the protective effects of these reproductive parameters to the associated lower rates of ovulation, modulation of endogenous estrogen production, and the development and differentiation of breast tissues that occur during pregnancy and lactation. Probably the same mechanism explains the high risk of breast cancer associated with the use of oral contraceptives revealed by our study. Burkman et al,[14] reported the slight increase in the risk of breast cancer associated with oral contraceptive use. Earlier studies concluded that breast cancer is more likely among women who started oral contraceptives at an earlier age and continued its use for a long time,[15] especially among women with a positive family history of breast cancer.[16] A family history of any malignancies independently predicted a BI-RADS score of 4 or 5. This underscores the genetic element in increasing the risk of breast cancer.[17]

The limited information on the use of oral contraceptives and the type of malignancies reported among family members precluded detailed study of those variables. Nevertheless, the record of the OCA provided a good source of information on the characteristics of women who are likely to have BI-RADS 4–5.

CONCLUSION

Screening programs should target women of low parity, those who never breastfed (regardless of their level of parity), those who received oral contraceptives, and those with a positive family history of any type of malignancies. The initiative of

the OCA is a successful model of the contribution of the nongovernmental sector in addressing public health problems. The continuous public support to such activities is necessary to increase its coverage in areas outside the capital city. The improvement of OCA records and its expansion to include detailed information on breast cancer risk will offer in the future a rich source of epidemiological data for further studies.

Disclosure
The authors declared no conflicts of interest. No funding was received for this study.

Acknowledgements
Authors acknowledge director and staff of the Oman Cancer Association (OCA), Muscat for sharing the information.

REFERENCE

1. Al-Lawati JA, Mabry R, Mohammed AJ. Addressing the threat of chronic diseases in Oman. Prev Chronic Dis 2008;5(3) [cited 2012 February 15]. Available from: http://www.cdc.gov/pcd/issues/2008/jul/07_0086.htm.
2. World Health Organization. GLOBOCAN 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012 [cited 2014 June 30]. Available from: http://globocan.iarc.fr/Pages/fact_sheets_population.aspx.
3. Amir E, Freedman OC, Seruga B, Evans DG. Assessing women at high risk of breast cancer: a review of risk assessment models. J Natl Cancer Inst 2010 May;102(10):680-691.
4. Narod SA. Hormone replacement therapy and the risk of breast cancer. Nat Rev Clin Oncol 2011 Aug;8(11):669-676.
5. Yin D, Morris C, Allen M, Cress R, Bates J, Liu L. Does socioeconomic disparity in cancer incidence vary across racial/ethnic groups? Cancer Causes Control 2010 Oct;21(10):1721-1730.
6. Allgood PC, Duffy SW, Kearins O, O'Sullivan E, Tappenden N, Wallis MG, et al. Explaining the difference in prognosis between screen-detected and symptomatic breast cancers. Br J Cancer 2011 May;104(11):1680-1685.
7. World Health Organization. World Health Statistics, 2008 [cited 2014 July 4]. Available from: http://www.who.int/whosis/whostat/EN_WHS08_Full.pdf.
8. Smith RA, Cokkinides V, Brawley OW. Cancer screening in the United States, 2008: a review of current American Cancer Society guidelines and cancer screening issues. CA Cancer J Clin 2008 May-Jun;58(3):161-179.
9. D'Orsi CJ, Sickles EA, Mendelson EB, Morris EA, editors. ACR BI-RADS® Atlas, Breast Imaging Reporting and Data System. Reston, VA, American College of Radiology; 2013.
10. Liu YT, Gao CM, Ding JH, Li SP, Cao HX, Wu JZ, et al. Physiological, reproductive factors and breast cancer risk in Jiangsu province of China. Asian Pac J Cancer Prev 2011;12(3):787-790.
11. Vatten LJ, Romundstad PR, Trichopoulos D, Skjaerven R. Pregnancy related protection against breast cancer depends on length of gestation. Br J Cancer 2002 Jul;87(3):289-290.
12. Russo J, Moral R, Balogh GA, Mailo D, Russo IH. The protective role of pregnancy in breast cancer. Breast Cancer Res 2005;7(3):131-142.
13. Lodha R, Joshi A, Paul D, Lodha KM, Nahar N, Shrivastava A, et al. Association between reproductive factors and breast cancer in an urban set up at central India: a case-control study. Indian J Cancer 2011 Jul-Sep;48(3):303-307.
14. Burkman R, Schlesselman JJ, Zieman M. Safety concerns and health benefits associated with oral contraception. Am J Obstet Gynecol 2004 Apr;190(4)(Suppl):S5-S22.
15. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and hormonal contraceptives: collaborative reanalysis of individual data on 53 297 women with breast cancer and 100 239 women without breast cancer from 54 epidemiological studies. Lancet 1996 Jun;347(9017):1713-1727.
16. Grabrick DM, Hartmann LC, Cerhan JR, Vierkant RA, Therneau TM, Vachon CM, et al. Risk of breast cancer with oral contraceptive use in women with a family history of breast cancer. JAMA 2000 Oct;284(14):1791-1798.
17. McPherson K, Steel CM, Dixon JM. ABC of breast diseases. Breast cancer-epidemiology, risk factors, and genetics. BMJ 2000 Sep;321(7261):624-628.