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MAMMOGRAPHIC BREAST DENSITY IN MALAYSIAN WOMEN WITH BREAST CANCER

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ABSTRACT

The objective of this study was to examine the mammographic breast density of women with breast cancer detected on voluntary mammographic screening at two selected screening centers in Malaysia. This was a retrospective study of Full-Field Digital Mammography (FFDM) images of 150 Malaysian women with biopsy-proven breast cancer. The study population comprised 73 Malays (37.7%), 59 Chinese (39.3%) and 18 Indians (12.0%). The Tabár breast density Patterns (I - V) were used to evaluate mammographic breast density. Data were analyzed using descriptive statistics. The results were compared with findings from a similar study on a group of 668 women who did not have breast cancer. The results showed that 44.7% of the study population had dense breasts (Patterns IV and V), 14.7% had predominantly fatty breasts (Patterns II and III) while 40.7% had Pattern I. The proportion of study population with dense breasts decreased with age. In conclusion, the proportion of women with dense breasts decreased with age. Majority of the women with cancer (44.7%) had dense breasts of Tabár Patterns IV and V, which has been associated with increased risk of breast cancer detected by voluntary mammographic screening. The results support the notion that increased breast density is a risk factor of breast cancer.

Key Words: Breast density, full-field digital mammography, women with breast cancer

INTRODUCTION

The mammogram is a projected image of a compressed breast and hence superimposed breast structures. Breast appearance on mammogram, varies among women due to differences in tissue composition and differences in the radiographic attenuation properties of fat, stroma and glandular tissues. Fat is radiographically lucent and appears dark. Fibro-glandular tissues and other mammary structures are radiographically dense and appear white; this is commonly referred to as mammographic breast density.

Previous studies have shown that high mammographic breast density is an important breast cancer risk factor (Boyd et al., 2007). Other researchers considered increased mammographic breast density a moderate independent risk factor of breast cancer (de Stavola et al., 1990). Measurement of mammographic breast density can be highly subjective and variable (Kopans, 2008). Different classification schemes of breast density have been used clinically. The first such classification was introduced by Wolfe in 1976. He described four different Patterns based on qualitative and quantitative criteria of breast parenchyma (Wolfe, 1976). Wolfe believed that the amount and volume of connective and epithelial elements within the breast can be related to breast cancer risk and that this is especially valid in women before the age of 60 years (Wolfe et al., 1983). Boyd et al (1995) proposed a semi-quantitative score of six categories as an attempt to increase reproducibility of the classification system. Tabár and Dean (1982) found Wolfe's classification of limited practical value. The Tabár breast density classification was proposed as a modification of Wolfe's classification with five Patterns based on histologic-mammographic correlations (Gram et al., 1997; Tot et al., 2000).

Typical mammographic findings from breast cancer screening mammograms would include information on asymmetrical breast density. Usually, a mammographic abnormality is followed up first by additional imaging studies, such as ultrasound, and if the lesion still appears suspicious it may be biopsied.

In our similar recent study (Jamal and Cheung, 2014) on 668 women without breast cancer, we found that there was no statistically significant difference ($p > 0.01$) in mammographic breast density in the three ethnic groups, namely Malay, Chinese and Indian. The mammographic breast density reduces with increasing age in all three ethnic groups.
The objective of this study was to examine the mammographic breast density of women with breast cancer detected on voluntary mammographic screening at two selected screening centers in Malaysia.

MATERIALS AND METHODS

Study Population

In Malaysia, mammographic breast density is routinely recorded at the time of voluntary mammography breast screening. The study populations are those women scanned with the use of mammography and followed up with Ultrasound and confirmed with BIRADS Diagnostic scheme. This retrospective study was performed at two voluntary screening mammographic centers in Malaysia with the approval of the administration of both centers. Both centers use FFDM systems with supplementary ultrasound whenever required, followed by image-guided sampling to confirm the diagnosis of breast cancer. As the women' identities need not be revealed, their informed consent and ethical committee approval were deemed unnecessary.

The study was conducted from April 2012 to February 2014. The pre-operative FFDM images of 150 women with proven breast cancer were reviewed by four radiologists. This study population was from a larger group of 2885 women whose FFDM images were reviewed as another part of a bigger on-going study. Table 1 shows the number of study population, their ethnic and age distribution.

Table 1: Ethnic distribution of study population

Ethnic Group	**Number of Women (%)**	**Age (Years)**	
		(Min, Max)	**Average ± SD**
Malay	73(48.7)	(34,71)	51.3 ± 8.5
Chinese	59(39.3)	(34,69)	52.4 ± 7.8
Indian	18(12.0)	(32,72)	52.9 ± 9.6
Total	150(100.0)	(34,80)	51.9 ± 8.3

SD: Standard Deviation

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Assessment of Mammographic Breast Density

Standard two-view (Craniocaudal (CC) and Mediolateral Oblique (MLO)) FFDM images were reviewed on the BARCO 5 megapixel monitors at both centers. The mammographic breast density from these images were evaluated and classified using the Tabár breast density classification by four experienced radiologist in breast imaging. Each radiologist was provided with Figure 1 and Table 2 (Gram et al., 1997), to aid them in categorizing mammographic breast density in each mammographic image.

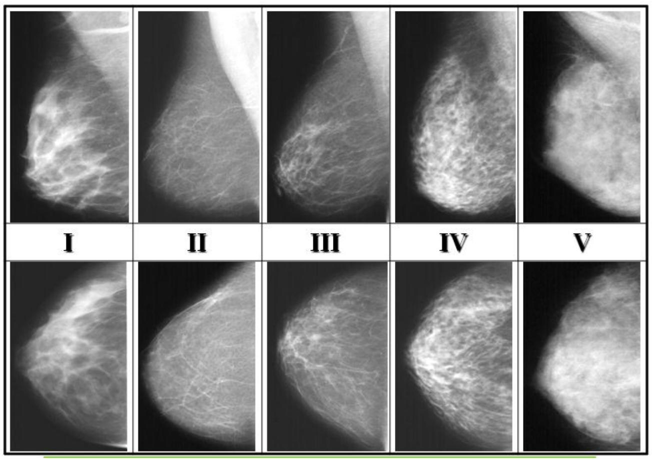

Figure 1: Collection of Tabár Pattern for both Craniocaudal (CC) and Mediolateral Oblique (MLO) views

Table 2: A description of Tabár Patterns (Gram et al., 1997)

Tabar's Patterns				
I	**II**	**III**	**IV**	**V**
Scalloped contour and Cooper's ligaments Evenly scattered Terminal Lobular Ductal Units (TLDU's), 1-2 mm nodular densities on mammogram Oval-shaped lucent areas corresponding to fatty replacement Pattern I usually evolves to either Pattern II or III	Complete fatty replacement	Combination of retroareolar prominent duct Pattern due to periductal elastosis and fatty involution	Extensive nodular & linear densities throughout the breast Linear densities are due to periductal elastosis Nodular densities often represent proliferating glandular structures that are considerably larger than the normal lobules (Adenosis)	Homogeneous, ground glass like, structureless fibrosis with convex contour

Data Analysis

For the purpose of analysis, Pattern 1 was considered separately, while Patterns II and III were collectively grouped as fatty breasts, and Patterns IV and V were grouped together as dense breasts. Data were also analyzed using descriptive statistics.

The results were then compared with our earlier findings (Jamal and Cheung, 2014) of mammographic breast density on FFDM in a group of 668 Malaysian women who did not have breast cancer.

RESULTS AND DISCUSSION

Mammographic breast density according to Tabár Patterns and age is presented in Table 3. The table also shows the age breakdown in these study population. Overall, 44.7% of the 150 women with breast cancer had dense breasts (Patterns IV and V), 14.7% had fatty breasts (Patterns II and III), and 40.7% had mammographic breast density Pattern I. Figure 2 shows distribution of Tabár Pattern for the study population.

Table 3: Mammographic breast density according to Tabár Pattern and age

Age Group (Years)	TABAR Pattern (Number of women)			Total Number of Women (%)
	I	II & III	IV &V	
<50	21	7	39	67(44.7)
51-60	28	10	25	63(42.0)
>60	12	5	3	20(13.3)
Total	61	22	67	150(100.0)

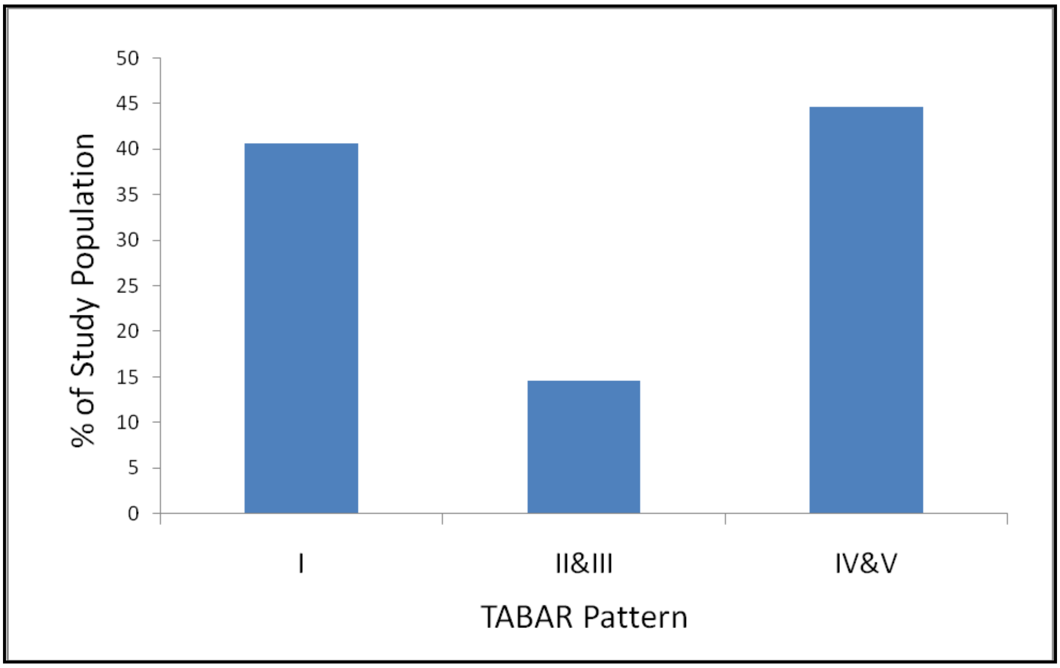

Figure 2 : Distribution of of Tabár Pattern for the study population

Results from the present study are compared with those of similar recent study on women without breast cancer in Table 4, relating to mammographic breast density of Tabár Patterns. Women with increased mammographic breast density are known to be at a higher risk of developing breast cancer. It has been estimated that women with the highest mammographic breast density may have a four- to six-fold increased risk of breast cancer compared to women who have less dense breast tissue (Byrne et al., 1995). Dense breasts make mammography less sensitive in breast cancer detection, potentially leading to lower rates of detection and higher stage at presentation (Lehman et al., 2005). Reports of differences in mammographic breast density by race have implied that genetic and environmental factors may in part determine mammographic breast density (Tice, 2009).

Table 4: Comparison of Tabár Patterns of the study population with that of women without breast cancer

Study	**Number of women**	**TABAR Pattern (% of study population)**		
		I	**II & III**	**IV & V**
Present study of women with cancer	(n=150)	40.7	14.7	44.7
Previous study on non-cancer women (Jamal and Cheung, 2014)	(n=668)	47.9	23.5	30.5

Mammographic breast density is important for two main reasons. Firstly, increased density is a major reason for failure to detect small breast cancers. Secondly, the dense breast is a predictor of higher risk of developing breast cancer. Mammographic breast density has been classified into Patterns proposed by Wolfe (1976), Tabár (Gram et al., 1997) and is featured under the BIRADS system (ACR, 1993).

In this study, we have opted to use the Tabár classification to categorize the mammographic breast density based on the appearance of the breasts on FFDM mammographic images. The reason for this choice is that the classification is based on anatomic-mammographic correlation using 3-dimensional sub-gross thick slice technique which has been fully described by Gram et al. (1997).

Our results showed that 44.7% of the study population had dense breasts of Tabár Patterns IV and V, which is associated with increased risk of developing breast cancer (Tabar et al., 2005) detected by mammographic screening. The results support the notion that increased breast density is a risk factor of breast cancer. This higher incidence of Tabár Patterns IV and V reflected the breast cancer incidence correlated with breast density, even though there are multiple risk factors involved in breast cancer occurrence (Zulfiqar et al., 2011).

We found that only 14.7% of study population has fatty breasts of Patterns II and III. This may be explained by the fact that Wolfe et al. (1983) and Tabar and Dean (1982) had reported that breast cancer risk is lowest in fatty breasts, categorized as N1 in Wolfe’s classification, and Patterns II and III in Tabar’s classification. These two Patterns are not associated with increased risk of developing breast cancer, and facilitate the mammographic detection of cancers.

We also found that 40.7% of the study population had density Pattern I on their mammogram images. Pattern I is characterized by relatively equal proportions of fibrous tissue, radiolucent adipose tissue, and nodular and linear densities, and is the most common Pattern seen in premenopausal women (Gram et al., 1997). Tabár Pattern I was not used in categorizing the mammographic appearance into either fatty or dense because the four building blocks, namely radiolucent adipose tissue, homogeneous fibrous tissue, linear and nodular intra-mammary densities which are equally represented in this Pattern. Furthermore with age-related involution Pattern 1 regresses gradually to the fatty mammographic Patterns II and III (Tabár and Dean, 1982; Tot et al., 2000).

The majority of women with Patterns IV and V in our study were in the cohort of less than 50 years of age (Table 3) as compared to the cohort of 51–60 years. This may be explained by the fact that our study population is those women with cancer, who have undergone screening mammography. This finding may also indicate the suitability of mammographic screening program for cohort of less than 50 years of age in the country.

Table 3 also shows that for Tabár Patterns IV and V, there is a decline in mammographic density with increasing age. Majority of women (44.7%) are in the cohort of less than 50 years of age. As expected, these dense Patterns became least common in women over the age of 60. In this latter group of older women, Pattern I (predominantly fat) is dominant.

The results (Table 4) show that 44.7% of the study population of women with breast cancer had dense breasts of Tabár Patterns IV and V, compared with only 30.5% of 668 women without breast cancer (Jamal and Cheung, 2014). Again, this may be explained by the fact that higher mammographic breast density is associated with increased risk of developing breast cancer (Tabar et al., 2005) and even though there are multiple risk factors involved in breast cancer occurrence (Zulfiqar et al., 2011). Previous work amongst Caucasian women (Chen et al., 2004) have led to the finding that high breast density is a risk factor for breast cancer. The results support the notion that increased breast density is a risk factor of breast cancer.

Limitations of the Study

The major limitation of this study is that it is based on the findings in only 150 women. This may be unavoidable, as the women with breast cancer detected by mammographic screening is small as compared with those detected by other modalities.

CONCLUSIONS

In conclusion, the proportion of women with dense breasts decreased with age. Majority of women with cancer (44.7%) had dense breasts of Tabár Patterns IV and V, which has been associated with increased risk of breast cancer detected by mammographic screening. The results support the notion that increased breast density is a risk factor of breast cancer.

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