The Normal Types of Ultrasound Breast Morphology (Glandular Tissue And Fat Lobules) among Women of Different Age Groups in Golden Horses Health Sanctuary

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Abstract

Objective: The present study analyzed the normal types of breast morphology, and breast echo structure using ultrasound evaluation while examining the difference in breast morphotypes among Malaysian females according to age groups and ethnicity.

Methods: between October 2013 and December 2014, a survey was prospectively conducted on women attended the imaging department of Golden Horses Health Sanctuary, Sri-Kembangan located in Klang Valley, Selangor, Malaysia for general checking using Philips ultrasound iu22. Both breasts were scanned utilizing clockwise, overlapping radial approach with linear array probe L17-5 (5-17 MHz), depth 3.5-4.0 cm and gain 86-87% for each woman.

Results: 615 women were examined within age groups from 20-70 years old and different ethnic group (Malay, Chinese and Indian). Findings of ultrasound images revealed that Indians owned the highest mean score of breast tissues in premenopausal age group compared with others, the mean of glandular tissue (length × width) for Indian respondents was 22.51 nm ± 8.79 mm for right upper outer. The mean of fat lobules (length × width) of right lower outer for Indian and Malay respondents at pre-menopausal were 26.57 mm ± 12.05 mm and 27.10 mm ± 11.51 mm respectively, while in Chinese respondents were 15.84 mm ± 9.51 mm. Approximately the left breast has the same values as right breast in each breast tissue.

Conclusion: This study observed that the prevalence and wide range size of ultrasound breast tissue between premenopausal and postmenopausal women were varying among the three ethnic groups. Also revealed that; ultrasound can be a good first row image modality in breast imaging.

Keywords: Breast morphology; Ultrasound; Age; Ethnic

Introduction

The breast which is primarily influenced by the endocrine system serves as a secondary sex organ in humans and also possesses the ability to produce milk in mammals. With these vital functions of the breast, it is important for the radiologist to understand the normal anatomy and physiology of it, in order to be able to identify abnormalities which may occur [1]. Even though ultrasound technique has been thought to be the best technique for the detection of breast abnormalities, it has been recorded by researches that, in the last few years a number of radiologists have experienced problems in distinguishing between normal and pathological changes in the breast based on age by ultrasound procedure [2].

The major anatomical structures in the breast include skin, fat, facial layers, Cooper ligaments, fibro glandular tissue, lymphatic, and neurovascular structures, which are all placed over the chest wall. The volume of fibro glandular tissue in women differs with age, with many women having more fat within the breasts after menopause [3]. Previous study states that breast development occurs in different phases of a woman's life [4]. The development of the mammary gland as a complex organ starts in the early phase of gestation with a steady change in shape, function and size from puberty to menopause [5-6]. Recent researches have added new knowledge about the anatomy of the breast which indicates fat in the breast to be hypoechoic and dark gray in color, while fibroglandular tissue is hyperechoic and white in gray-scale intensity [7]. A number of factors such as age, hormones, reproductive history, diet and genetics influence the density of a woman's breast. A study conducted by other researchers found age, hormones, reproductive history, genetics and diet (body habitus) to be

the major contributors to breast density [8]. Among all these factors, age is the major determinants noted; the breast of a younger woman is often dense containing more glandular which reduces and changes into fatty as female advances in age. Hormones, diet and genetic factors determine the amount of density remaining when as female grows older [8].

The main reason for conducting this study is to obtain knowledge and information about breast morphology within the Malaysian population involving different age and ethnic groups. Current study also contributes to the body of academic and professional knowledge.s

Patients and Method

Study design and population

Between October 2013 and December 2014, we conducted an analytic cross-sectional research design study on Females that went to the Imaging Department at Golden Horses Health Sanctuary (GHHS)

for breast checking in. Respondents were identified and selected using simple random sampling method. Subjects were randomly selected from the list of respondents that went to the Imaging Department in the Golden Horses Health Sanctuary using SPSS. This list was used as sample frame. A standardized questionnaire that was designed in two languages (major Malaysian languages); Malay and English. The forward-backward translation method was used in translating the questionnaire into each language to ensure conceptual equivalence.

As Klang Valley`s residents comprised of three major ethnic groups (Malay, Chinese and Indian) we chose Golden Horses Health Sanctuary (GHHS) located in Seri Kembangan district located within Klang Valley, Selangor, Malaysia and almost all of the outpatients reside in Klang Valley.

Sample size was calculated based on previous finding since no study has been conducted on normal ultrasound breast morphology. For this reason, the mean percent mammographic density in premenopausal according to a study carried out by Butler et al., was 47.4 and the mean percent mammographic density in postmenopausal was 41.7. In total, six hundred and fifteen females were selected. Ethical clearance for the study was reviewed and approved by Jawatankuasa Etika, Universiti Putra Malaysia and Medical Research Ethics Committee (MREC) of Ministry of Health, Malaysia before starting with the study. Written consent was signed by each case and verbal agreement for interview participation and do breast scan by ultrasound was obtained from each subject.

Cases recruitment

Women cases were with confounded diagnosis of normal breast with age ranging 20-70 years of age, not pregnant, not breast feeding, without any hormonal and surgical problems selected from imaging department where women attending GHHS for general checkup. All interviews were conducted at the imaging department in GHHS. Data were collected by scan respondents using ultrasound after having the informed consents signed by the participants.

Data collection

Data was collected using self–administered questionnaires which was developed and validated especially for this study. All women subjected to bilateral whole breast ultrasound examination using Philips ultrasound iu22. Both breasts were scanned utilaizing clockwize, overlapping radial approch. The breast divided into four quadrants. Each quadrant was scanned in a radial fashion to accommodate the arrangement of ducts in the breast with a linear array probe L17-5 (5-17 MHz), depth 3.5-4.0 cm and gain 86-87%. Data are acquired at the Region of Interest (ROI).

Statistical analyses

All data entry and analyses were performed using SPSS° software, version 21.0 (SPSS Inc., Chicago, IL, USA). Normality test were done and all of the quantitative data were found to be normally distributed. Descriptive statistical analysis, which included mean and Standard Deviation (SD) were used for continuous variables, whereas frequency and percentages were used for categorical variables in describing the study population, also maximum, minimum and rang, were used to characterize the data.

Breast image analysis

For measuring and analyzing the breast tissues, Philips DICOM Viewer software (R 3.0 - SP03) was used. The measuring unit for each tissue is (mm), and the dimensions were obtained. Furthermore, all the measured data were collected by uni-dimensional (length) for support ligaments and ducts while two-dimensional (length × width) for glandular tissue and fat lobules, sizing from three different areas for each tissue three readings were taken and average obtained to minimize errors.

Result

Total of 700 respondents were selected as sample for this study. However, 85 respondents (12.14%) returned questionnaires were omitted due to either incomplete answers or were inaccurately completed. Hence, 615 females participated in this study were counted. The giving response rate in this study was 87.9%.

Breast morphology of right and left breast of pre-menopausal and post-menopausal groups in different age and ethnic group.

The tables below (Tables 1-4) shows that there was a race distribution of the study population, using U/S for breast tissues for four different quadrants of the right and left breast of respondents in pre-menopausal and post-menopausal groups (Figures 1 and 2).
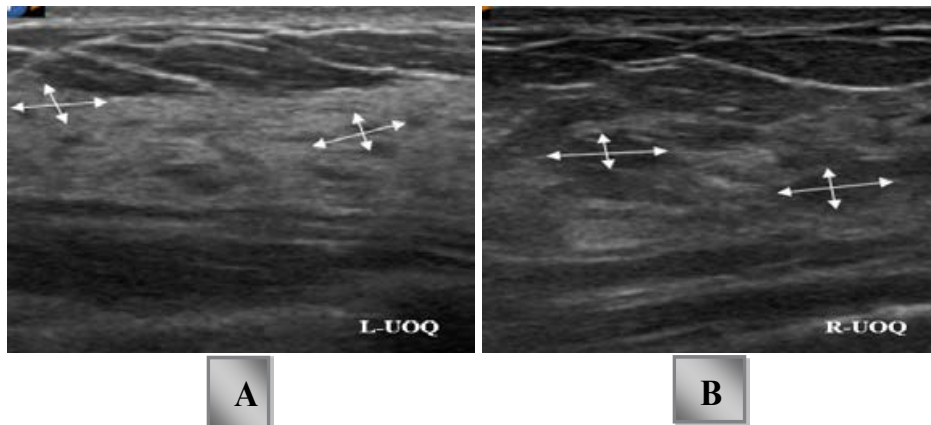
Glandular tissue

The mean of glandular tissue (length × width) in pre- menopausal group for upper outer and upper inner quadrants have the highest values compared with lower outer and lower inner quadrants which have the least values in each ethnic group for example, we can see that mean of glandular tissue in right upper outer in pre-menopausal and post-menopausal for Indian respondents were 22.51 mm ± 8.79 mm and 22.80 mm ± 10.08 mm respectively while in Chinese respondents were 17.73 mm ± 7.53 mm and 14.18 mm ± 6.35 mm. In post-menopausal age group the average value of glandular tissue in upper outer of right and left breast still have the highest values in each ethnic group compared to the other quadrants which became less than values in pre-menopause and are a bit different from each other.
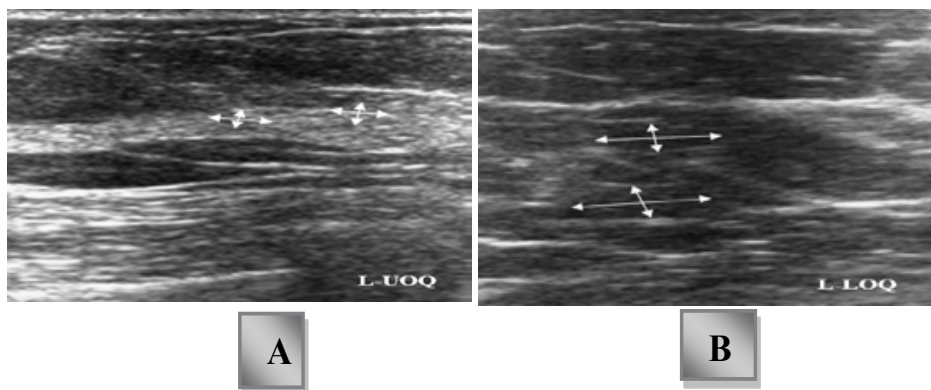
Fat lobules

Indian females have a larger mean for fat lobules (length x width) in four areas compared to Malay and Chinese and Chinese have a smaller mean. The mean of fat lobules (length × width) in pre-menopausal group for lower outer and lower inner quadrants in right and left breast have the highest values compared to the upper outer and upper inner quadrants which have the least values in each ethnic group. For example, the mean of fat lobules in right lower outer and lower inner for Indian and Malay respondents for pre-menopausal and post-menopausal were 26.57 mm ± 12.05 mm, 27.10 mm ± 11.51 mm and 22.52 mm ± 12.21 mm, 15.26 mm ± 8.46 mm respectively while in Chinese respondents were 15.84 mm ± 9.51mm and 17.91 mm ± 10.65 mm. In post-menopausal age group the average value of fat lobules in lower outer and lower inner of right and left breast still have the highest values in each ethnic group compared to the other quadrants which became slightly higher than values in pre-menopause and a little difference exist among them. In addition, range and standard deviation in pre-menopausal and post-menopausal groups in different quadrants and ethnic group were large.

Discussion

Aging of human breast tissue is often followed by particular structural and functional changes and these changes have been linked by several research findings to the development of aging-related cancer. At the cellular level, morphological and functional changes which may include increased cell size and decreased proliferation may result in aging of human mammary epithelial cells [9]. The development of the

Figure 1: Radial ultrasound scan of pre-menopausal females' breast with breast morphology (A) glandular tissue (hyperechoic) of 31 year's old Chinese woman with 2 children (B) Fat lobules (hypoechoic) of 47 year's old Malay woman with 3 children.

Figure 2: Radial ultrasound scan of post-menopausal females' breast with breast morphology (A) glandular tissue (hyperechoic) of 60 year's old Malay woman with 4 children (B) fat lobules (hypoechoic) of 60 year's old Malay woman with 3 children.

Breast Quadrants	Ethnic	n	Right breast					Left breast				
			Mean	SD	Minimum	Maximum	Range	Mean	SD	Minimum	Maximum	Range
Upper outer	Malay	112	19.25	6.81	5.78	39.75	33.97	19.55	8.13	7.77	63.98	56.21
	Chinese	167	17.73	7.53	3.60	45.41	41.81	16.92	7.00	3.19	48.96	45.77
	Indian	48	22.51	8.79	8.65	43.32	34.67	22.80	10.08	2.79	47.87	45.08
Lower outer	Malay	112	13.90	6.21	4.60	45.19	40.59	13.33	5.31	4.32	29.80	25.48
	Chinese	167	12.90	6.21	1.84	48.67	46.83	12.39	5.09	2.27	30.66	28.39
	Indian	48	16.29	6.86	4.92	33.98	29.06	16.00	7.59	4.70	37.41	32.71
Lower inner	Malay	112	11.52	5.95	4.20	43.92	39.72	11.81	5.79	4.17	35.14	30.97
	Chinese	167	11.15	5.50	2.27	37.37	35.10	10.42	4.73	2.04	25.80	23.76
	Indian	48	14.42	10.22	4.11	63.81	59.70	14.90	7.99	2.33	37.21	34.88
Upper inner	Malay	112	15.59	5.18	5.40	29.01	23.61	15.29	5.70	5.96	35.50	29.18
	Chinese	167	14.18	6.35	4.03	39.76	35.73	13.28	8.59	3.29	39.50	36.21
	Indian	48	18.21	8.94	4.84	46.46	41.62	18.64	8.59	3.17	41.06	37.89

Data presented as n patient incidence, Mean, SD, Minimum, Maximum and Range.
Table shows the mean of glandular tissue in different breast quadrants, upper outer, lower outer, lower inner and upper inner.
Ethnic group, Malay, Chinese and Indian.

Table 1: Glandular tissue among ethnic group in different quadrants of right and left breast in pre-menopausal group.

breast begins from the stage of fetal development with mammary ridge or milk line which is usually a thickening in the chest region after which the nipples and milk duct system begin to develop when the baby is born, then at puberty stage, child-bearing phase, during menstrual cycle and finally at menopause [4].

The reason why about 15% of patients that are children and adolescent are advised to do an ultrasound is because of the suspicious symptoms detected in the breast during physical examination such as palpable masses and pains. This was revealed in a study conducted among 62 females aged 8 weeks to 20 years; the study was conducted

Breast Quadrants	Ethnic	n	Right breast					Left breast				
			Mean	SD	Minimum	Maximum	Range	Mean	SD	Minimum	Maximum	Range
Upper outer	Malay	91	19.53	8.07	4.13	46.99	42.86	20.40	8.72	5.65	49.00	43.35
	Chinese	149	15.56	5.89	5.18	30.95	25.77	15.97	5.27	5.40	30.68	25.28
	Indian	48	20.33	5.99	2.03	34.23	32.20	21.72	6.79	3.66	36.57	32.91
Lower outer	Malay	91	13.75	5.64	5.92	35.59	29.67	14.95	6.22	4.99	34.89	29.90
	Chinese	149	10.84	3.64	3.90	24.61	20.71	11.06	3.73	4.17	36.00	31.83
	Indian	48	14.65	4.99	6.13	31.24	25.11	14.67	4.54	4.10	29.54	25.44
Lower inner	Malay	91	11.34	7.76	2.60	72.00	69.40	11.10	4.72	3.40	31.83	28.43
	Chinese	149	9.42	3.34	2.97	25.09	22.12	9.14	3.13	3.30	22.04	18.74
	Indian	48	10.85	3.28	2.05	10.53	18.48	10.74	3.61	2.72	22.42	19.70
Upper inner	Malay	91	13.55	5.31	5.44	35.15	29.71	15.49	5.49	7.22	29.21	21.99
	Chinese	149	12.72	5.02	4.20	30.83	26.63	13.07	5.12	3.19	34.11	30.92
	Indian	48	16.15	4.76	2.00	24.74	22.74	16.50	4.80	5.26	28.76	23.50

Data presented as n patient incidence, Mean, SD, Minimum, Maximum and Range.
Table shows the mean of glandular tissue in different breast quadrants, upper outer, lower outer, lower inner and upper inner.
Ethnic group, Malay, Chinese and Indian.

Table 2: Glandular tissue among ethnic group in different quadrants of right and left breast in post-menopausal group.

Breast Quadrants	Ethnic	n	Right breast					Left breast				
			Mean	SD	Minimum	Maximum	Range	Mean	SD	Minimum	Maximum	Range
Upper outer	Malay	112	22.19	14.21	2.75	99.28	96.53	20.45	11.51	2.75	73.85	71.10
	Chinese	167	14.10	8.98	1.98	51.29	49.31	15.28	9.87	1.30	78.97	77.67
	Indian	48	22.99	11.47	1.96	48.85	46.89	22.95	11.75	2.13	45.22	43.09
Lower outer	Malay	112	22.68	12.26	2.20	71.06	68.86	22.52	12.21	3.87	74.74	70.87
	Chinese	167	15.83	9.51	3.18	59.22	56.04	15.26	8.46	2.74	47.94	45.20
	Indian	48	26.57	12.05	5.40	59.16	53.76	15.26	8.46	2.74	47.94	45.20
Lower inner	Malay	112	25.14	12.84	1.99	66.86	64.87	25.21	13.71	4.15	65.02	60.87
	Chinese	167	17.91	10.65	2.34	60.88	58.54	17.61	11.57	1.56	102.66	101.10
	Indian	48	27.10	11.51	4.75	54.44	49.69	28.09	14.17	6.91	67.90	60.99
Upper inner	Malay	112	23.90	13.20	2.75	65.25	62.50	23.31	13.4	2.75	58.30	55.55
	Chinese	167	17.27	10.19	2.25	65.10	62.85	16.87	9.31	2.20	59.33	57.13
	Indian	48	24.66	10.78	3.50	49.27	45.77	25.76	13.14	4.90	60.52	55.62

Data presented as n patient incidence, Mean, SD, Minimum, Maximum and Range.
Table shows the mean of fat lobule in different breast quadrants, upper outer, lower outer, lower inner and upper inner.
Ethnic groups, Malay, Chinese and Indian.

Table 3: Fat lobules among ethnic group in different quadrants of right and left breast in pre-menopausal group.

Breast Quadrants	Ethnic	n	Right breast					Left breast				
			Mean	SD	Minimum	Maximum	Range	Mean	SD	Minimum	Maximum	Range
Upper outer	Malay	91	21.40	10.90	1.61	56.89	55.28	20.29	11.19	2.80	59.50	56.70
	Chinese	149	17.83	10.77	4.92	77.40	72.48	15.81	7.41	3.85	53.70	49.85
	Indian	48	25.64	11.19	5.40	56.07	50.67	22.97	8.56	5.27	43.47	38.20
Lower outer	Malay	91	23.58	11.29	5.53	79.87	74.34	23.20	11.95	1.50	61.10	59.60
	Chinese	149	18.12	9.43	5.10	61.78	56.68	18.48	9.41	4.77	57.05	52.28
	Indian	48	26.58	14.56	8.70	83.63	74.93	24.38	9.55	6.67	50.00	43.33
Lower inner	Malay	91	26.86	14.50	2.69	110.90	108.21	26.82	13.11	4.76	68.25	63.49
	Chinese	149	19.84	9.58	4.80	59.77	54.97	21.63	12.13	5.00	67.20	66.70
	Indian	48	30.93	13.44	10.78	77.33	66.55	29.17	13.01	9.52	81.15	71.63
Upper inner	Malay	91	24.85	12.02	3.38	83.73	80.35	24.79	12.97	2.90	64.67	61.77
	Chinese	149	18.99	9.01	4.23	49.00	44.77	19.12	8.61	4.21	51.22	47.01
	Indian	48	27.81	11.8	11.75	62.93	51.18	26.65	10.90	8.81	65.93	67.11

Data presented as n patient incidence, Mean, SD, Minimum, Maximum and Range.
Table shows the mean of ducts in different breast quadrants, upper outer, lower outer, lower inner and upper inner.
Ethnic groups, Malay, Chinese and Indian.

Table 4: Fat lobules among ethnic group in different quadrants of right and left breast in post-menopausal group.

using standard sonography. It is important for a specialist to have prior knowledge of the normal breast and its variants in order to be able to detect abnormalities [5]. Breast ultrasound plays a major role in the identification, diagnosis, and staging of breast cancer and the different soft-tissue structures in the breast have different echogenicities [10].

In order not to not cause any harm to patients' and mistake normal anatomy for pathologic abnormality, it is necessary to have a prior knowledge of the breast anatomy; the anatomy of a normal breast can be gotten using imaging modalities. This knowledge is also essential in planning of appropriate breast interventions and avoiding

unwanted complications caused by wrong procedures [6,11]. The major anatomical structures in the breast include skin, Less or no subcutaneous fat may be seen in young women because the quantity of subcutaneous fat varies considerably with age and parity and large inter individual variation occur. As it is structurally homogeneous, subcutaneous fat appears hypoechoic [12].

In this study, wide spectrum of breast morphology was found. These findings are similar to the study conducted, [13] observed that breast glandularity decreases with increasing age (20.1% reduction of breast glandularity from 47 to 72 years). This decrement is due to an increase in the proportion of adipose tissue in the breast. This trend is similar to that reported [14-16] for German, British, and Jamaican studies, respectively. Interestingly, we found that the greatest rate of change occurs after the age of 50 years whereas, [15,17] reported that the greatest rate of change occurs between the ages of 45 and 55 years. It presented as hyperechoic oval or spindle-shaped in each quadrant of right and left breast of pre-menopause and post-menopause among ethnic groups. More study conducted [18], investigating the influence of age and/or menopausal status on the association between breast density and risk have showed inconsistent results and found a relatively stronger association in premenopausal women than in postmenopausal women, although the difference was not statistically significant.

Different studies with conflicting findings on the relationship between breast density and race have been reported. A study [19] indicated that all quadrants mammographic density is significantly higher in Asians than in African Americans. The prevalence of female breast cancer in Malaysia is highest among Chinese, followed by the Indian and Malay ethnicities. The findings of another study conducted in Malaysia revealed that Chinese women had the highest odds of having dense breasts. However it is interesting to note that breast cancer incidence is highest amongst the Chinese ethnic group in Malaysia as compared to Indians who had the lowest percentage of breast cancer incidence [20]. The findings of this study also revealed that ultrasound can be a good first row image modality in breast imaging.

Limitations

As this study was designed to be cross-sectional. It may not be possible to conclude that the factors were found to be associated with normal breast morphology predated onset. Incidentally all the respondents that were selected from GHHS which is located in urban area; hence, the result cannot be generalized to both urban and rural.

Recommendation

This study only classified normal breast morphology and its associated factor among different age and ethnic groups. It would be helpful to compare breast morphology and its associated factors among age and ethnic groups to determine which ethnic group has more breast morphology size. It is also important to note that this kind of study can also be conducted as regards other parts of the human body based on different modes of operation using an ultrasound machine.

Conclusion

This work which is the first comprehensive ultrasound study to be conducted in Malaysia focuses on the classification of ultrasound breast morphology among premenopausal and postmenopausal women of different ethnic groups in Malaysia. It concentrated on the B-Mode ultrasound, which is the most popular device being used for the evaluation of breast disease and images, displayed in grey scale. There is no other study result that agrees with the result of this study

as most of the other studies conducted focused on asymmetry between left and right breast by mammogram as a sign of breast disease [20,21].

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