Comparative Study of Mass Shape Based on BI-RADS Mammography Classification with Histopathological Grading in Breast Cancer

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Abstract

Background: Breast cancer can be diagnosed using imaging modalities and histopathology. The description of the mass shape found via mammography needs to be confirmed by an anatomical pathology examination. Therefore, research regarding the comparison of mass shape based on BI-RADS mammography classification with histopathological grading of breast cancer patients is important.
Objective: Analyzing the differences in mass shape based on the BI-RADS mammography classification between histopathological grading of breast cancer patients at Dr. Soetomo General Hospital Surabaya.
Method: This type of research is an analytical observational study with a comparative approach using patient medical records in the form of age data, mammography examinations of breast cancer patients who were diagnosed based on histopathology results at Dr. Soetomo General Hospital Surabaya during the period January 2017 to December 2021.
Results: Total breast cancer samples at Dr. Soetemo General Hospital Surabaya for the period January 2017 to December 2021 is 229 data. Breast cancer patients are dominated by the age group 40 – 49 years (37.6%), the majority of masses are found in the right breast (54.1%), the shape of the mass is predominantly irregular (86.5%), the most histopathological grading is in grade 3 (53.3%), and the comparison of mass shape between histopathological grading had a value of $p = 0.137$ ($p > 0.05$).
Conclusion: Breast cancer patients at Dr. Soetomo General Hospital Surabaya for the period January 2017 to December 2021 is dominated by the 40 – 49 year age group. Most of the masses were in the right breast. The most common mass shape found was irregular and the most frequent histopathological grading was grade 3. There were no differences in mass shape between histopathological gradings.

Keywords: breast cancer, mammography, Nottingham Grading System, mass shape

1. Introduction

Breast cancer is the most malignant breast disease among women in the world. By 2020, there was an increase in breast cancer cases of 2,261,419 patients (WHO, 2020). According to Komite Penanggulangan Kanker Nasional (2015), breast cancer is a malignant condition of the breast tissue that starts from the ductal epithelium and its lobulus. Major risk factors for breast cancer generally include age, diet, waist size, hip size, belt-to-belly ratio, body mass index, high-density lipoprotein cholesterol, triglycerides, pregnancies over three years, number of years of menstruation, atypical hyperplasia on previous biopsies, and a history of similar carcinomas (Antony et al, 2018).

According to the World Health Organization or WHO (2021a), in the last five years there have been 7.8 million living women traced to breast cancer by the end of 2020. Cases in every country found that breast cancer can occur at any age (after puberty) with increasing degrees later on. Prevalence data of breast cancer cases in Indonesia reached 65,858 out of 396,914 total cases of all types of cancer (Globocan, 2020).

Modality of breast imaging that can be used for diagnosis and evaluation among others, mammography, ultrasound sonography (USG), and magnetic resonance imaging (MRI). This breast imaging modality is useful in evaluating women who have signs or symptoms that may lead to breast cancer. To date, there are no tests that confirm that a woman does not have breast cancer. To confirm the diagnosis of breast cancer, triple diagnosis is needed. Triple diagnosis is a procedure that is performed to ensure a lump in the breast through clinical, radiological, and histopathological examinations. Physical examination assesses different tissue characteristics from mammography and provides a unique set of information about the tissue being studied. Just as decisions should be made based on suspicion of mammography in the face of normal clinical examination, management decisions should also be made on the basis of clinical findings when faced with a negative mammogram. Since it is a well-established fact that mammograms do not reveal all breast cancers, some of which may be negligible, statements that indicate a decreased accuracy of mammogram on dense breasts are often justified.

Mammography is an examination technique to evaluate breast tissue using low-dose x-rays. Mammography can be used as early detection of breast cancer to reduce the risk of death (American Cancer Society, 2019). Abnormal mammograms will often detect masses or lumps, which can be cysts, fibroadenomas, intracystic tumors, or cancers (Ohnuki dkk., 2021).

The findings and mammogram results will be interpreted by experts in radiology using standard systems. This system is called the Breast Imaging Reporting and Data System or BI-RADS. The goal is to sort the results into categories 0 to 6 (American Cancer Society, 2022). The grouping of BI-RADS based on the morphology of its mass is divided into forms and margins (American College of Radiology BI-RADS Atlas 5th Edition, 2013).

Previously, Tamaki et al. (2011) conducted a comparative study in Japan by comparing histopathological grading between mass shapes. Thus, the researchers wanted to conduct a similar comparative study but through a different point of view, namely by reversing the comparative element, which is a comparison of mass shapes based on the classification of BI-RADS mammography between the histopathology grading of breast cancer patients at Dr. Soetomo General Hospital Surabaya. It is hoped that this research can help professionals in establishing the diagnosis as well as can be a benchmark on future research.

2. Methods

2.1 Data Collection

This research is a type of analytical observational research with a comparative approach using retrospective study. The sampling technique used consecutive samples of medical records including age and mammography examination data of breast cancer patients at Dr. Soetomo General Hospital Surabaya who were diagnosed with breast cancer based on the results of anatomical histopathology and then taken according to the inclusion and exclusion criteria for a specified period of time, that is January 2017 to December 2021.

The sample of this research is as follows.

A. Inclusion criteria

a. Data from mammography examination in patients diagnosed with breast cancer at Dr. Soetomo General Hospital Surabaya must be available.
b. Data of histopathological examination such as tissue biopsy and/or surgical intervention at Dr. Soetomo General Hospital Surabaya must be available.

B. Exclusion criteria

a. Breast cancer patient who has medical records of mammography at Dr. Soetomo General Hospital Surabaya and mentioning mass shape not based on BI-RADS mammography 2013.
b. Breast cancer patient who has medical records of mammography at Dr. Soetomo General Hospital Surabaya and mentioning histopathological grading that is not based on Nottingham Grading System.

2.2 Data Analysis

The accumulated data is subsequently processed through data acidification. This data processing consists of editing and data entry. On the data collection sheet, the attributes of the medical record are grouped according to the research variables that have been designed, and presented in the category table. The data was processed observationally analytically using a comparative approach to compare mass shapes based on the BI-RADS mammography classification with histopathological grading in breast cancer patients at Dr. Soetomo General Hospital Surabaya through the fisher exact method.

3. Result

An analytical observational research on the Comparative Mass Shape Study Based on BI-RADS Classification of Mammography with Histopathology Grading in Breast Cancer at Dr. Soetomo General Hospital Surabaya during the period January 2017 to December 2021 has been carried out by evaluating the medical records of patients. The total patient data obtained is 229 samples. The medical records of patients with breast cancer at Dr. Soetomo General Hospital Surabaya includes age, mass location, mass shape, and histopathological grading. The results of this study are presented in the form of tables.

Table 1. Age distribution of breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya

Age	Data
< 40 years of age	17 (7,4%)
40 – 49 years of age	86 (37,6%)
50 – 59 years of age	70 (30,6%)
60 – 69 years of age	52 (22,7%)
70 – 79 years of age	4 (1,7%)
Total	229 (100%)

Based on the age distribution in table 1, the prevalence of breast cancer patients in the period January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya is in the age range 40 – 49 years of age with 86 data (37.6%), while patients 70 – 79 years of age are the age group with the smallest amount of breast cancer incidence with 4 data (1,7%). During this period, there are no patients ≥ 80 years of age with breast cancer that meets the inclusion criteria of the study.

Table 2. Mass location distribution of breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya

	Breast	
Total Number of Patient	Right	Left
	124 (54,1%)	105 (45,9%)
Total	229 (100%)	

Table 3. Mass shapes distribution of breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya

	Mass Shape		
Total Number of Mass	Oval	Round	Irreguler
	20 (8,7%)	11 (4,8%)	198 (86,5%)
Total	229 (100%)		

Based on the mass location distribution in table 2, breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya mostly have mass on the right breast amounting to 124 data (54.1%). Furthermore, as seen from table 3, the most mass shape are irregular, forms of 198 data (86.5%).

Table 4. Number of Histopathological Gradings in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya

	Histopathological Grading		
Total Number of Hiastopathological Grading	Grade 1	Grade 2	Grade 3
	30 (13,1%)	77 (33,6%)	122 (53,3%)
Total	229 (100%)		

Based on table 4, the number of breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital Surabaya is in grade 3 with 122 data (53.3%).

Table 5. Comparison of Mass Shapes between Histopathological Grading

	Histopathological Grading			Total	p Value
Mass Shape	Grade 1	Grade 2	Grade 3		
Oval	3 (10%)	4 (5,2%)	13 (10,7%)	20 (8,7%)	0,137
Round	3 (10%)	1 (1,3%)	7 (5,7%)	11 (4,8%)	
Irreguler	24 (80%)	72 (93,5%)	102 (83,6%)	198 (86,5%)	
Total	30 (100%)	77 (100%)	122 (100%)	229 (100%)	

This research uses the Fisher Exact method. Obtained a value of $p = 0.137$ ($p > 0.05$). Based on table 5, either grade 1, grade 2, or grade 3, the majority of mass shape obtained are irregular.. Therefore, it can be concluded that there is no significant difference in mass shape between grades 1, 2, and 3 histopathology of breast cancer.

4. Discussion

Breast cancer has unmodified risk factors, one of which is related to age. According to the epidemiological study of breast cancer in Asia, it was found that the risk for breast cancer increases in women over 40 years old (Youn and Han, 2020). The facts that the researchers found in the context of East Java are precisely in Dr. Soetomo General Hospital Surabaya, which is a small part of Asia, has a continuity of age distribution compared to the research found by Youn and Han. This is supported by the results of a study conducted by Kang et al. (2020) in Korea with breast cancer patients data predominantly from the age group 40 – 49 years. (Yoshimura et al., 2018). Different results were found in a study in Thailand that showed that women aged 50 or over had an increased incidence of breast cancer (Youn and Han, 2020).

The incidence of breast cancer is also closely linked to the condition of estrogen hormone that affects the growth and development of female reproductive organs. Long-term exposure to estrogen hormone in the human body can increase the risk of breast cancer (Hasnita et al., 2019). Breast fat cells will produce large amounts of aromatase enzymes as people age. As a result, there will be an increase in local estrogen levels that triggers breast cancer in postmenopausal women. The estrogen levels of the tumor formed can multiply and then the tumour develops (Ningrum and Rahayu, 2021).

According to a study by Alotaibi et al. (2018), most tumors are found in the left breast. Their research described that breast cancer patients with left lateralization had a larger number of cases compared to right lateralization. There are several possible reasons for this outcome. First, mothers usually choose to use their right breasts when breastfeeding, although regional preferences may vary. Second, women with a dominant right hand tend to proactively detect and treat the lumps on their left breasts by checking them more frequently (Alotaibi et al., 2018). Third, the left chest is bigger and denser than the right chest (Mokone-Fatunla et al., 2019).

As mentioned by research at Subdivision of Oncology Surgery, Department of Surgery, Faculty of Medicine, Universitas Udayana / Sanglah Central General Hospital in 2014-2018, showed consistency from the previous explanation, that the mass location distribution of breast cancer is mostly found on the left, although the difference presentation between the right and left breasts is not very different (Putra et al., 2020). In a study by Ervina et al. (2021), no significant difference was obtained in the distinction of mass breast cancer in both locations.

Unlike the previous findings, this research found more mass on the right breast. Prevailing breast cancer in the right breast is often found with a higher family record of positive breast cancer, an increased rate of advanced disease and metastasis, as well as a lower five-year survival rate in relation to the size of the cancer and the stage of its development (Al Saad et al., 2022).

In determining a malignant condition, breast mass is the most important finding among various types of breast abnormalities, such as microcalcifications and architectural distortions. The presence of mass in the breasts, can be seen using an effective tool and commonly used as a diagnostic support, namely mammography. The mass found will provide morphological information including the type of shape, margin, and density. A study has proven that mass shape can predict molecular subtypes of breast cancer to distinguish different types of malignancy. From a visual examination, if the tumor shape is irregular then radiologists can suspect it as a luminal group. On the contrary, if the tumor is round or oval then it's most likely HER2 or Basal-like (Altan, 2020; Singh et al., 2020). In invasive and infiltrative breast cancer, irregular mass forms tend to be more commonly found (Watkins, 2019).

This histopathological grading refers to Nottingham Grading System (NGS) that considers three cellular characteristics in tissue to determine the level of differentiation of tubular formation, nuclear pleomorphism, and the number of mitoses. Information regarding cell differentiation capabilities will help pathologists in measuring tumor aggressiveness and patient prognosis (Peregrina-Barreto et al., 2022). The calculated value of NGS exceeds the prognostic value of other important factors, such as tumor size, patient age, menopausal status, and completion of additional treatment. It is known that NGS is equivalent to lymph node classification (Davidson et al., 2019). It is important to emphasize that the description of characteristics depends on the observer's perception. Observer error in diagnosis can occur even when viewed with a professional eye. Therefore, the diagnosis process can be facilitated by the development of supporting tools such as Computer-Aided Diagnosis (CAD) systems. Automatic analysis of breast tissue images can also support and compare diagnostic results (Peregrina-Barreto et al., 2022).

The position of grade 3 as the highest histopathological grading finding in this study shows results that are in line with previous research conducted by Syarti et al. in 2020. A study said that grade 3 tumors are often found in advanced stage patients with negative estrogen receptors. Grade 3 breast cancer can increase cell proliferation, a series of genes related to the cell cycle, and immune activity (Takahashi et al., 2020). A tumor that falls into the grade 3 category shows more DNA aberrations. S100A8 is a gene expression found in grade 3 breast cancer. This gene is responsible for metastasis and development of cancer cells. If this gene is overexpressed, it will cause lymphovascular invasion because it indicates poor prognosis and tumor differentiation (Khairana et al., 2022).

Breast cancer cases require multidisciplinary treatment including clinical, radiology, and anatomical pathology examination. The aim is to determine a specific diagnosis and plan further therapy (Budijono, 2019). As the first step in detecting breast cancer, mammography is the gold standard for radiological examination to see microcalcifications before clinical signs appear. Apart from reducing mortality rates and improving treatment at an early stage, mammography can also increase the accuracy of diagnosis. It is important to note that examining experts must be alert to overdiagnosis, especially when a patient is diagnosed with breast cancer after screening but there are no clinical signs or life-threatening conditions. This can be fatal due to the effects of radiation received and inappropriate therapy (Soekersi et al., 2022).

Radiological results with suspicion of breast cancer further require anatomical pathology confirmation. Histopathological examination is the main parameter for determining the type of breast cancer. This examination specimen uses patient tissue obtained through surgery. The tissue will then be processed into paraffin blocks and then made into slides to view the microscopic morphology (Wangsa et al., 2018). Through histopathological grading, prognostic assessment can be determined according to microscopic interpretation (Peregrina-Barreto et al., 2022).

Based on researchers' observations in various studies, no one has yet proven a correlation between the mass shape and each histopathological grading. Therefore, this research comes with the argument that there is indeed no significant relationship between those two. Research like this is still interesting to carry out, because no correlation has been found, so there are no differences between the two components.

5. Conclusion

Analytical observational research on Comparative Study of Mass Shape Based on BI-RADS Mammography Classification with Histopathological Grading in Breast Cancer at Dr. Soetomo General Hospital Surabaya during the period January 2017 to December 2021 concluded that the age of the youngest breast cancer patient was 29 years old and the oldest was 78 years old. The majority of patients were aged 40 – 49 years with a total of 86 data (37.6%). Meanwhile, patients aged 70 – 79 years are the age group with the lowest total number of breast cancer sufferers, namely 4 data (1.7%). Most of the masses in patients were located in the right breast (54.1%). Apart from that, the most common form of mass was irregular (86.5%). The dominance of the histopathological grading of breast cancer patients was grade 3 with a total of 122 data (53.3%). The mass form between histopathological grading in breast cancer patients was not different.

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