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Prevalence of Risk Factors for Breast Tumors Detected by Mammography a Cross-Sectional Study

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ABSTRACT

This cross-sectional study sought to determine the association between demographic variables and the presence of breast tumors (tumors detected by mammography). This study included 100 patients who referred to mammographic examination in medical city of Baghdad Department (Oncology Teaching Hospital) during a six-month period from September 2024 to February 2025. Demographic and clinical data were collected, including history of hormones treatment, age, BMI, and the history of family with disease. Full-volume mammographic assessments were individually examined by board-certified radiologists. Multivariate analyses were conducted to ascertain if any of the above associations were statistically significant (p-value of <0.05) between risk factors and tumor. There was a significant relationship with age (older patients) and positive family history (increased risk relative to comparison subjects) for possible malignant mammographic features (e.g., spiculated mass margins and microcalcifications). In the multivariate model, body mass index and prior hormone replacement therapy also trended toward significance but did not match the threshold. This study identifies important demographic and mammographic imaging predictors of breast tumors. These results justify additional exploration and provide supporting evidence for broad-based risk stratification to enable early diagnosis of the disease and thus reduce the risk of deterioration of the patient's injuries and reduce the risk of death.

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1- INTRODUCTION

Breast cancer, has a high prevalence, ranks among the lead to cause morbidity and mortality among women around the world. Diagnosis at an early stage is a key factor in making the overall outcome of the disease better [1]. Mammography is the mainstay of breast cancer screening programs and is essential for detecting early changes leading up to the conversion to malignant disease. Although screening protocols have been standardized, patient-specific risk factor profiles can vary substantially from one individual to another and influence the chance of a positive mammographic result [2].

Breast cancer is a heterogeneous disease, and many population-based studies have found multiple demographic, reproductive, and lifestyle-related factors to be significant risk factors for it, including increasing age, family history, reproductive history, and obesity [3, 4]. Moreover, mammographic features like breast density and microcalcifications are important indicators to differentiate benign from malignant lesions. Previous studies assessed these predictors

separately; however, limited research has integrated these risk factors and investigated the association between these predictors in a clinical population with a strong multivariable statistical method [5- 9].

The study aim is to find the frequency of risk factors in the general population who receive routine screening mammograms as well as the association of each risk factor with breast tumors [10]. In particular, this work highlights the combination of demographic and historical clinical and imaging data towards a more granular risk stratification that could be utilized for clinical decision-making. Women with localized breast neoplasia; the study hypothesis proposes groupings of demographic risk indicators that, when assessed by means of multivariate logistic regression, will be statistically significant predictors of breast neoplasia. This may improve the clinical practice of mammography by identifying cases at risk of being missed, thereby promoting earlier treatment.

2- METHOD

1.1. Study Design and Patient Population

This is a cross-sectional study carried out at an oncology teaching hospital, Iraq, on 100 consecutive female participants referred for diagnostic mammography. The study lasted for half a year, from September 2024 to February 2025. Informed consent for the study, both verbal and written, was obtained from participants, and inclusion criteria included patients older than 30 years of age. To avoid this confounding effect, we excluded patients with a previous breast cancer history or patients with a history of mastectomy. The data and personal information of the participants remained confidential. Ethical approval was granted from the Training and Human Development Center-Educational Medical City Dept., Ministry of Health-Baghdad.

Standardized information outlining potential risk factors included demographic variables such as age, body mass index, and the presence of a family history of breast cancer. Additionally, it encompassed reproductive history, including parity and age at first full-term pregnancy, as well as hormonal factors, which involved a history of hormone treatment and the use of oral contraceptives. We collected clinical data using standardized, content-validated questionnaires.

2.2. Mammographic Imaging and Data Collection

Mammography study was performed using contemporary digital mammography system, and the images were interpreted independently by two experienced breast imaging radiologists. Imaging findings were recorded, including density of the breast according to the BI-RADS classification system, microcalcification type, mass margins, and other critical characteristics. Disagreements between radiologists were settled by consensus. Where clinical pathology reports were available, they were integrated to confirm the imaging findings. Imaging was classified as benign, suspicious, or highly suggestive of malignancy based on accepted radiological criteria [11-13].

2.3. Statistical Analysis

A single, standardized software was used to perform the statistical analysis of the data; demographic and clinical data were summarized using descriptive statistics. Continuous variables (i.e., age and BMI) were reported as means ± standard deviations, whereas categorical variables were expressed as frequencies and percentages.

The main analyses were multivariate logistic regressions assessing the relationships between the different risk factors and detection of a breast tumor on mammography [14-15]. In the logistic regression model, independent variables included age, BMI, family history of breast cancer, reproductive factors, and specific mammographic findings. Modelled as odds ratios (OR) with 95% confidence intervals (CI). Significant predictors were defined as those with a p-value of less than 0.05 who achieved a specified significance level during the forward stepwise variable selection approach.
To ensure calibration, we validated model adequacy with Hosmer-Lemeshow goodness-of-fit tests. In addition, possible interactions between risk factors are assessed for their potential synergistic effect for enhanced prediction.

3- RESULTS AND DISCUSSION

3.1. Patient Demographics and Clinical Characteristics

100 female patients were included with a mean age of 52.3 ± 10.7 years were evaluated in this study. When observing the distribution of patients by age group, we found that 45% of patients were aged between 40 and 50 years, 35% were aged between 51 and 60 years, and the rest were patients aged 60 years or older, as shown in [Figure 1]. About 30% of all subjects had a positive family history for breast cancer. The study had a mean BMI of 27.8 ± 4.5 kg/m².

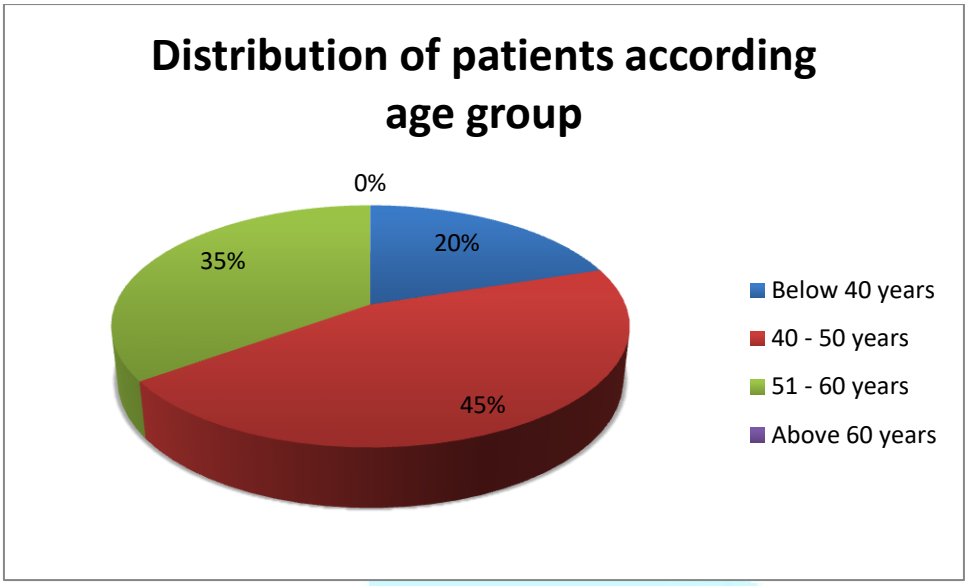

Figure 1: Distribution of patients according to age groups

In reproductive history, 60% of women had childbearing before age 30, and 25% had delayed first pregnancy (after age 35). Twenty percent of the cohort had a history of hormone replacement therapy (HRT), and 15% had a long-term history of using oral contraceptives after the age of 40 as shown in [Figure 2].

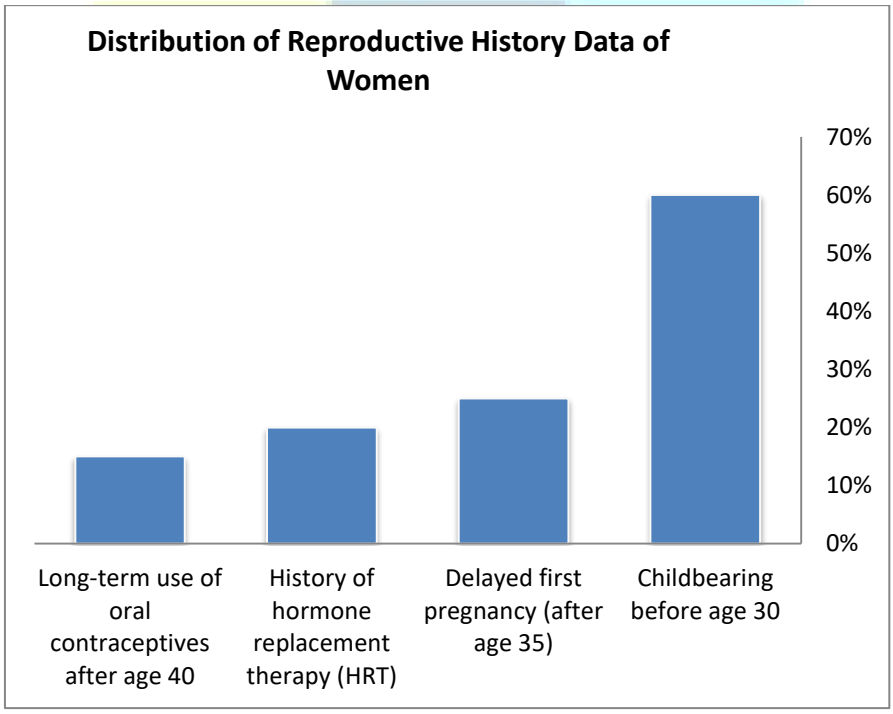

Figure 2: Distribution of Reproductive History Data of Women in the Study

3.2. Mammographic Findings and Tumor Characteristics

Patients underwent mammograms that detected varying degrees of radiologic changes. Forty percent of patients had (BI-RADS) breast density of heterogeneously dense breast tissue; 30 percent have (BI-RADS) dense glandular tissue, and 30 percent have (BI-RADS) scattered fibroglandular patterns of breast density.

Microcalcifications were seen in 25% of patients, and in 15% of cases, the patterns were suspicious for malignancy.
Mass lesions—Mild to moderate malignant lesions were found (18% were described as well-marginated; 18% as spiculated or irregular). Ten percent of cases showed architectural distortions and asymmetrical densities. Importantly, 10% of patients had an individual imaging feature, or a combination of features, that increased the suspicion of malignancy as shown in [Figures 3-5].

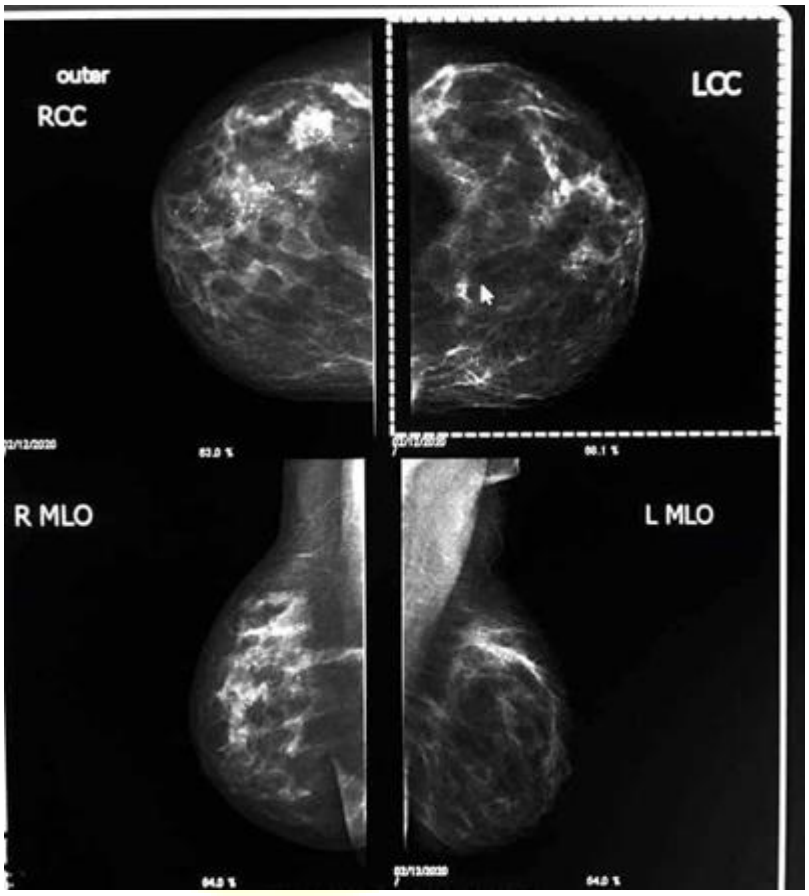

Figure 3: Standard views in right craniocaudal view, left craniocaudal view, right mediolateral oblique view, and left mediolateral oblique views, in a 45-year-old female patient LCC View: Suggestive for area of architectural distortion and spiculated margins, suspicious for mass/lesion, probably malignant. RCC View: there is some density (but more diffuse) with a less suspicious appearance. Left MLO: This view of the left breast demonstrates dense fibroglandular tissue, which may show asymmetry or abnormal calcifications.

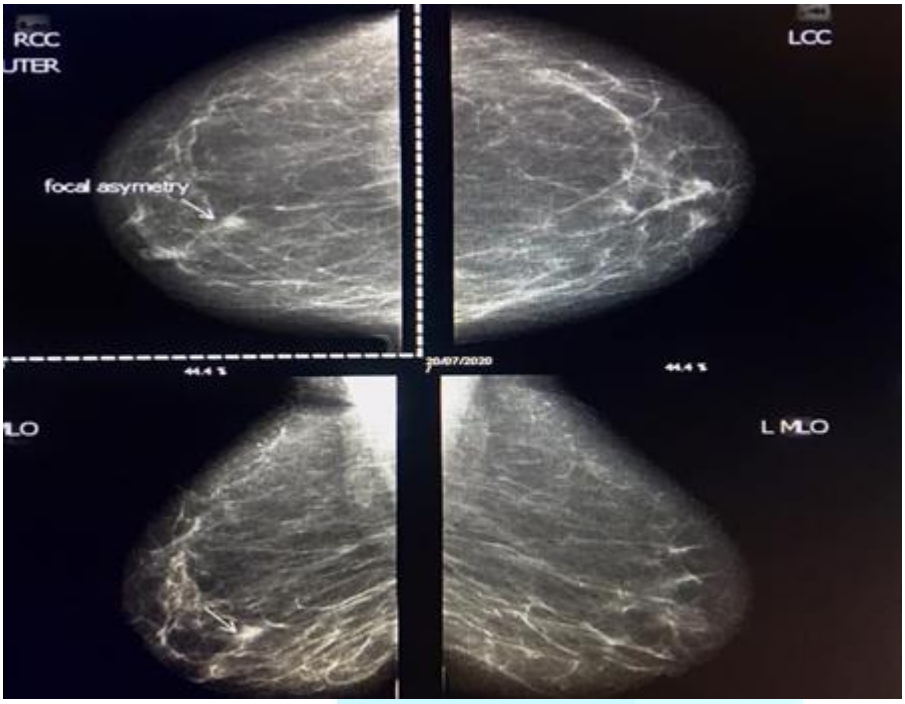

Figure 4: Female, 50 years (Right Craniocaudal ,Left Craniocaudal, Right Mediolateral Oblique, and Left Mediolateral Oblique) The RCC (Right Craniocaudal) view reveals a focal asymmetry — a small area of opacity that does not have the familiar glandular tissue appearance — that we can see bilaterally, except it is not symmetric on the corresponding LCC view; hence, this area will be flagged as focal rather than bilateral, suggest fibroadenomas.

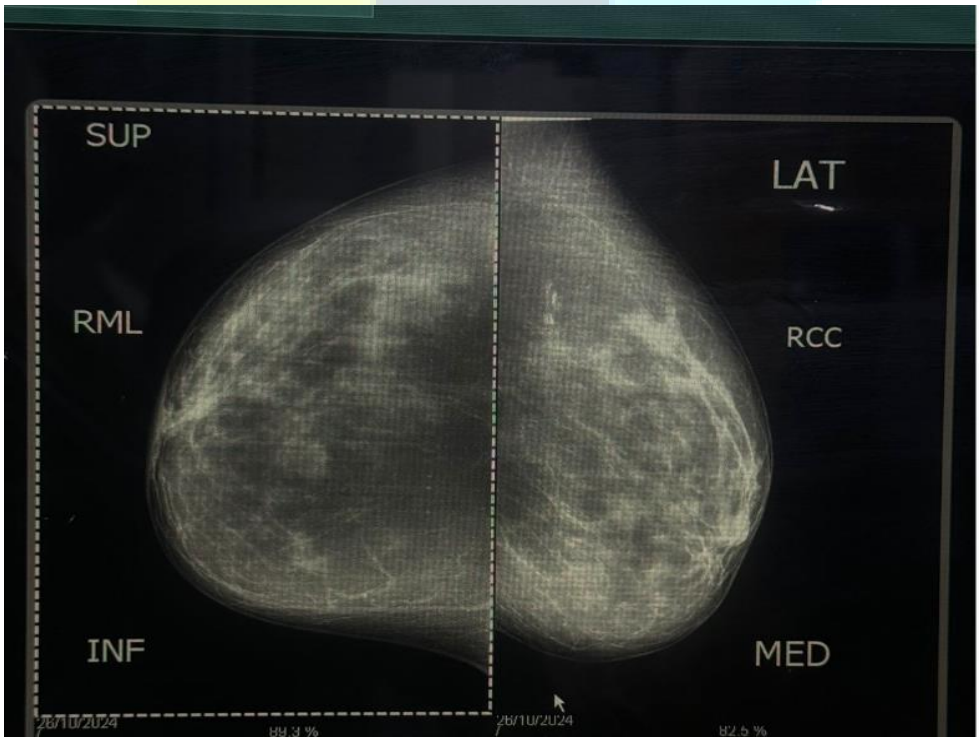

Figure 5: Mammogram of right breast (RML, RCC (right mediolateral view), right craniocaudal view) by 40-year-old female on the cross-sectional image in the RCC view (right image), there is a focal area of increased density in the central to medial aspect.

There is no obvious mass with spiculated margins; however, the area of opacity is irregular, so further evaluation is warranted. On the RML view (left image), there is a corresponding heterogeneously dense area, but once again, no definite mass or calcifications. The image shows heterogeneously dense breast tissue, which can mask underlying masses. Be linked with benign alterations, for example, fibrocystic alterations, fibroadenomas, or glandular tissue overlap. Or present as a new asymmetry or distortion, especially at the latter, early malignancy.

3.3. Analysis of Risk Factors

Multivariate logistic regression model based on tumor presence annotated on the mammography (dependent variable). On multivariable analysis, older age independently was associated with a positive tumor detection (OR = 1.08, 95% CI: 1.02–1.15, p = 0.007). In like manner, a history of breast cancer in the family was featured as a strong predictor (OR = 3.20, 95% CI: 1.50–6.80, p = 0.003). Based on mammographic features, the presence of microcalcifications in a suspicious distribution had an adjusted OR of 2.90 (95% CI: 1.20–7.01, p = 0.018).

Among the other variables, BMI, hormone replacement therapy, and reproductive history also showed trends toward association; however, when the variables were adjusted for confounding in the regression model, the associations did not approach significance. The calibration of the overall model was good, with an overall Hosmer-Lemeshow test p-value of 0.35, indicating an overall good fit of the model to the data as shown in Table 1.

Table 1: summarizes the distribution of risk factors and the corresponding odds ratios for tumor detection on mammography.

Risk Factor	Odds Ratio (OR)	95% Confidence Interval	p-value
Age (per year increase)	1.08	1.02 – 1.15	0.007
Positive Family History	3.20	1.50 – 6.80	0.003
Microcalcifications (suspicious)	2.90	1.20 – 7.01	0.018
BMI	1.05	0.98 – 1.12	0.15
HRT Use	1.65	0.70 – 3.90	0.23
Delayed First Pregnancy	1.40	0.60 – 3.30	0.41

These findings underline the significance of selected demographic as well as imaging characteristics in predicting the presence of breast tumors. This cross-sectional study elucidates demographic risk factors and mammographic findings according to breast tumor detection; however, demographic risk factors and mammographic findings are only part of the breast cancer detection picture. Tumor detection is associated with increasing age. This result agrees with [16]. Increasing age will influence many factors in our body, especially cells, hormones, and the immune system. Older age, as it relates to the buildup of DNA, means that, of course, every second harm or error someone has in relation to their genome, the more likely they'll have a cancer-causing hereditary mutation. —Hormonal changes: Similar to menopause, hormonal changes are changeable at some point in aging, which promotes tumor growth. —Immunesenescence: Aging can change the immune system and the immune system's ability to imprison new neoplastic cells from arising. Many studies indicate that the risk of having malignant changes in the breast increases with age.

There was similarly higher a significant risk of developing neoplasia among patients with a positive family history of breast cancer, affirming that genetic predisposition has an important role in the evolution of neoplasia; this result agrees with [17]. The research indicated that mutations in highly penetrant genes (which are transmitted in an autosomal dominant fashion) only account for 15% of all breast cancer cases. BRCA1 and BRCA2: Mutations in BRCA1 and BRCA2 are the most frequently inherited mutations in an autosomal dominant manner. Recent developments in genomic technologies are enabling both the swift identification of novel breast cancer predisposition genes and the high-throughput testing of multiple genes, sometimes within the same laboratory. Introduction — With the advent of next-generation sequencing technologies, custom next-generation sequencing panels have been designed to offer multiplex testing of a small number of breast cancer predisposition genes.

This underlines the importance of suspicious microcalcification patterns and the need for close radiological evaluation in the detection of malignancy at an early stage. Pixel-level findings Microcalcifications, by combining these with the clinical findings, breast mass, or cluster patterns, are the most recognized predictors of potential invasive cancer, even after adjusting for confounding factors in our data set.

While many studies have pointed to BMI and hormone replacement therapy as risk factors [18- 20], these features were not significant independent predictors after multivariate adjustment here. One possible explanation for this discrepancy may be due to sample size were small relatively and the heterogeneous nature of the distribution of these parameters in the population studied. Larger cohorts and carefully controlled confounders will be needed to determine if these factors could approach significance.

Some strengths of our study are the uniformity of imaging protocols, the validated questionnaires used to collect clinical data, and the strong multivariable logistic regression analysis performed. These approaches reduce the potential for measurement bias to confound the observed associations. Additional confirmation was achieved through an independent review of the mammographic findings by other radiologists, which further strengthened the reliability of the evaluations.

Nonetheless, some limitations should be taken into account. Then, the cross-sectional design of the study does not allow for the determination of cause and effect between risk factors and the development of a tumor. Second, they state that though the sample size of 100 patients is adequate for a first insight into the question, this also limits generalizability of the findings. Finally, because the study was performed at a single tertiary care center and participants were those referred for imaging rather than a random selection of the general population, a selection bias cannot be completely ruled out.

It is important to also note that these findings could reflect interactions between different risk factors and should be interpreted in this light. For example, older age and family history may have a multiplicative effect (vs. additive) on risk—a question that requires closer investigation in future prospective studies. Additionally, the low prevalence of some variables, such as hormone replacement therapy use, may have limited the capacity to observe statistically significant associations.

Although the study did not assess mammographic density directly, BI-RADS categories might reflect mammographic density, as mammographic density is a well-known risk factor of breast cancer. Breast density has been shown to correlate with risk of breast cancer, in part masking cancers [20] and in part due to underlying biological characteristics [21]. We observed some variation by density in our study, but additional stratified analyses are needed to fully clarify the effect of breast density on tumor detection in various types of patients.

The combination of demographic data with mammographic features, like that shown in this report, may allow for increased risk stratification and individualized patient management in clinical practice. These results will allow radiologists and oncologists to better guide treatment by making decisions about recommendations of biopsies for histology and guidelines for intervals of follow-up and screening programs specific to individual patients. In cases where patients present with several risk factors, a multifactorial assessment system that combines clinical information together with information from imaging is needed, making this especially relevant.

Last, but not least, our findings have potential implications in patient counseling and public health. Expectant identification of endogenous risks among women undergoing routine screening may correlate with systemic compliance with subsequent processes and early action in prevention. However, the development of better models to predict risk may depend on integrating genomic profiles and other imaging modalities to ultimately assist the practice of precision medicine.

4- CONCLUSION

The study showed increasing age, positive family history, and the presence of suspicious microcalcifications were strong predictors for breast tumors on mammography. While many risk factors that have been raised previously (e.g., BMI, HRT) did not reach statistical significance in our analysis, some of these factors likely contribute to a risk and represent areas of interest for larger cohorts with greater diversity in exposure to assess. These results highlight the value of combining detailed patient history and advanced imaging data in the early detection and risk categorization of breast cancer. These results have very important clinical consequences. The findings of this study will help healthcare professionals to ensure optimal screening of patients, customize follow-up, and facilitate early diagnosis. In addition, this work will help to inform future research into the relationship between demographic, clinical, and imaging characteristics to facilitate more accurate prediction models and personalized treatments.

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انتشار عوامل الخطر لأورام الثدي التي تم اكتشافها من خلال التصوير الشعاعي للثدي: دراسة مقطعية

الـخـلاصـة

سعت هذه الدراسة المقطعية إلى تحديد العلاقة بين المتغيرات الديموغرافية ووجود أورام الثدي (الأورام التي تم اكتشافها بواسطة التصوير الشعاعي للثدي). شملت هذه الدراسة 100 مريضة تمت احالتهم إلى الفحص الشعاعي للثدي في دائرة مدينة الطب / بغداد (مستشفى الأورام التعليمي) خلال فترة ستة أشهر من سبتمبر 2024 إلى فبراير 2025. تم جمع البيانات الديموغرافية والسريرية، حيث شملت العلاج الهرموني والعمر ومؤشر كتلة الجسم وتاريخ العائلة مع المرض.

تم فحص تقييمات التصوير الشعاعي للثدي من قبل أطباء اشعة معتمدين. أجريت تحليلات متعددة المتغيرات للتأكد مما إذا كانت أي من الارتباطات المذكورة أعلاه ذات دلالة إحصائية (قيمة $p < 0.05$) بين عوامل الخطر والورم. حيث كانت هناك علاقة مهمة مع العمر (المرضى الأكبر سنًا) والتاريخ العائلي الإيجابي مع نسبة الاصابة بالمرض اي هنالك زيادة نسبة الخطر وبالتالي احتمالية ظهور اصابات خبيثة في التصوير الشعاعي للثدي (على سبيل المثال، تكلسات الثدي).

في تحليل اخر شمل مقارنة بين عدد من المتغيرات، اتجه مؤشر كتلة الجسم والعلاج الهرموني نحو الدلالة الاحصائية، لكنهما لم يطابقا الحد الأدنى المطلوب اي بمعنى لاتوجد دلالة احصائية بين المتغييرين اعلاه.

حددت هذه الدراسة مؤشرات ديموغرافية وتصوير الثدي بالأشعة السينية لأورام الثدي. تبرر هذه النتائج بضرورة إجراء المزيد من الابحاث وتوفير أدلة داعمة لتصنيف المخاطر على نطاق واسع، لتمكين التشخيص المبكر للمرض وبالتالي تقليل خطر تدهور إصابات المريض وتقليل خطر الوفاة.