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28634 – ADVANCES IN ARTIFICIAL INTELLIGENCE AND GENETIC TESTING FOR THE PREVENTIVE DIAGNOSIS OF BREAST CANCER

Maria Catarina Wilhelms Guimarães*, Isabella Schnorr Paglioli, Rafaela Zell, Camila Salles, Marina Amaral

***Corresponding author:** mariacatarina.w@rede.ulbra.br

Introduction: Every year, over one million women worldwide die from breast cancer. In Brazil, neoplasms are the second leading cause of death among women, with breast cancer ranking first. Early diagnosis is essential for reducing the stage at presentation of breast cancer, contributing to a favorable prognosis. According to the American Cancer Society, when breast cancer is diagnosed at early stages, the five-year survival rates are significantly higher than in advanced stages. Currently, the main diagnostic methods used include mammography, clinical examination, ultrasound, scintigraphy, PET scan, biopsy, histopathological and cytopathological exams, BRCA1 and BRCA2 genetic testing, among others. Artificial intelligence (AI) and machine learning (a branch of AI that enables programs to learn from data and identify patterns to make predictions) are increasingly being applied in the medical field, being used for image analysis, automated diagnosis, personalized pharmaceutical systems, among others. In recent years, performance studies comparing automated breast cancer detection in digital mammography and digital tomosynthesis with experienced radiologists have shown that these algorithms are reaching human-level performance. In addition to assisting in diagnoses through imaging exams, artificial intelligence and machine learning are capable of aiding in the detection and treatment of breast cancer by using genetic sequencing and histopathological images. **Methodology:** This is an integrative review conducted in March 2024 through searches in databases provided by digital bibliographies. From this search, 15 articles were identified and subsequently subjected to inclusion criteria. The inclusion criteria were: articles in Portuguese and English; published between 2001 and 2023; addressing the themes proposed for this study; and review studies available in full. The exclusion criteria were: duplicate articles; articles available only as abstracts; studies that did not directly address the research proposal; and articles that did not meet the other inclusion criteria. After applying these criteria, seven articles remained and were carefully reviewed for data collection. Additionally, books related to the area of interest were consulted to clarify concepts presented in the review articles. **Conclusion:** Although AI has shown significant promise in breast cancer diagnosis, there are still some aspects that require improvement to ensure even more accurate and effective diagnoses. These aspects include the interpretation of complex images, where the ability to identify small lesions, distortions, or microcalcifications in the early stages of breast cancer continues to challenge AI systems. Additionally, AI models can be limited by the diversity of available training data, highlighting the importance of representative and diverse datasets for proper generalization. Furthermore, protecting patient privacy and data security is essential when developing and implementing AI systems for breast cancer diagnosis. It is well known that early detection of breast cancer is crucial for improving survival rates. Although traditional diagnostic methods such as mammography, ultrasound, CT scans, and genetic testing remain the most widely used, AI and machine learning are increasingly prevalent and effective in disease diagnosis, helping to reduce errors and providing more reliable diagnoses. Nevertheless, despite the challenges in interpreting more complex images and ensuring data security, AI is surpassing many radiologists in image analysis and automated diagnosis.