Review / Derleme

Use of Artificial Intelligence in Breast Cancer: Current Approach Meme Kanserinde Yapay Zekâ Kullanımı: Güncel Yaklaşım

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Abstract: Breast cancer is one of the most common types of cancer among women worldwide and is still a major cause of death. More than 2 million women are diagnosed with breast cancer annually. Artificial intelligence has great potential in breast cancer diagnosis, treatment, and management. In addition to traditional imaging techniques, the analysis of genetic data is used by artificial intelligence in the process of breast cancer diagnosis. In addition, artificial intelligence plays an important role in treatment planning and follow-up of patients. Data analytics and extensive data integration also contribute to developments in this field. However, the audit and ethical responsibilities of artificial intelligence applications should be considered.
Keywords: Breast cancer, Artificial intelligence, Mammography, Diagnosis

Özet: Meme kanseri, dünya genelinde kadınlar arasında en yaygın kanser türlerinden biridir ve hala ölüm nedenleri arasında önemli bir yer tutmaktadır. Yılda 2 milyondan fazla kadına meme kanseri teşhisi konmaktadır. Yapay zekâ, meme kanseri teşhisi, tedavisi ve yönetimi konularında büyük bir potansiyele sahiptir. Geleneksel görüntüleme tekniklerinin yanı sıra genetik verilerin analizi, yapay zekâ tarafından meme kanseri teşhisi sürecinde kullanılmaktadır. Ayrıca yapay zekâ, tedavi planlaması ve hastaların takibi süreçlerinde de önemli bir rol oynamaktadır. Veri analitiği ve büyük veri entegrasyonu da bu alandaki gelişmelere katkı sağlamaktadır. Ancak yapay zekâ uygulamalarının denetim ve etik sorumlulukları göz önünde bulundurulmalıdır.
Anahtar Kelimeler: Meme kanseri, Yapay zekâ, Mamografi, Tanı

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1. Introduction

Breast cancer is one of the most common types of cancer among women and is still among the leading causes of cancer-related deaths worldwide. More than 2 million women are diagnosed with breast cancer each year (1). Early diagnosis and effective treatment of breast cancer can significantly increase the survival rates of patients. Artificial intelligence (AI) has great potential in this field and makes important contributions to breast cancer diagnosis, treatment and management. Therefore, in this article, we would like to demonstrate the success of the use of artificial intelligence in breast cancer screening, diagnosis and prediction of disease severity and emphasise that it should become widespread.

2. Artificial Intelligence in Breast Cancer Diagnosis

Early diagnosis of breast cancer can improve the patient's chances of survival. When diagnosing breast cancer, the traditional approach is to examine patients using imaging techniques such as mammography, ultrasound, magnetic resonance imaging (MRI). The interpretation of these images is performed by specialised radiologists. However, this process is time-consuming and may cause radiologists to work under a heavy workload.

By analysing mammography images, artificial intelligence can detect potential lesions and assess cancer risk. Deep learning algorithms can interpret mammography images more precisely and provide doctors with more accurate results. In addition, artificial intelligence can use genetic data to assess risk factors and predict disease risk.

We can identify two main ways to apply AI to breast cancer diagnosis; the first is based on image analysis and the second is based on histological data. State-of-the-art deep learning algorithms, when trained with large datasets of annotated images, allow very accurate image classification and can be easily used on histological images. In the context of breast cancer, deep learning methods can reliably assess whether the histological image indicates a normal tissue, a benign tumour, an in-situ carcinoma or an invasive carcinoma (2).

Artificial intelligence plays an important role in breast cancer diagnosis to improve and speed up the process: It can analyse genetic data and clinical information to assess patients' risk of breast cancer. This can help create personalised screening and monitoring plans. It can quickly process large amounts of image data and reduce the workload of radiologists. In addition, algorithms can be more sensitive than humans and can sometimes detect cancer lesions in the early stages (3).

Artificial intelligence in breast cancer diagnosis offers a number of advantages, such as speeding up the diagnostic process, improving accuracy and helping expert radiologists focus on more complex cases. However, this technology also faces some challenges, such as the quality of training data, the reliability of algorithms and ethical issues. Therefore, the use of AI in medical applications should be carefully managed and supervised by medical professionals.

3. Use of Artificial Intelligence in Treatment Planning

Breast cancer treatment includes various methods such as surgery, radiotherapy, chemotherapy and targeted therapy. Artificial intelligence can be used to personalise treatment plans, taking into account the individual patient's condition. In addition, artificial intelligence can make decisions based on important data to predict treatment outcomes and minimise side effects.

Today, people die not from primary tumours but from secondary tumours, i.e. metastases, which account for 90% of tumour deaths. According to World Health Organisation (WHO) statistics, about one third of these cancer deaths could be prevented by early detection and treatment. Estimating the risk of individual aggressiveness of primary breast cancer will allow physicians to choose the best treatment strategy, limiting overtreatment and side effects that harm the patient's quality

of life. Therefore, there is an urgent need to develop more sustainable and economically affordable predictive tools for personalised therapies. This seems particularly urgent in the context of immunotherapy, which in some cases is very effective but also extremely expensive. It is clear that it is crucial to identify in advance those patients who are most likely to respond. In this respect, artificial intelligence shows great promise in achieving the goal of classifying breast cancer patients according to the aggressiveness of their specific tumours, their individual risk of metastasis and their likelihood of responding to a particular treatment (3).

Correct identification of breast cancer patients at high risk of metastasis, prophylactic treatment and close follow-up may improve the prognosis of breast cancer patients. By identifying breast cancer patients at high metastatic risk, an earlier window for treatment can potentially be created. Previous studies predicted metastasis in breast cancer patients with established mathematical models (4, 5). Currently, most models are based solely on clinical or radiographic data. However, it is known that artificial intelligence-assisted models have wide application potential (6-8).

Högberg et al. aimed to validate the performance of prognostic prediction for breast cancer through artificial intelligence and to investigate the accuracy of prediction models for metachronous metastatic disease, bone metastasis and visceral metastasis. He emphasised that these models could potentially guide screening for metachronous metastatic disease and lead to the implementation of personalised prophylactic treatment for breast cancer patients at high risk of metastatic disease (9).

4. Artificial Intelligence in Follow-up and Recovery Monitoring

Monitoring and recovery process after breast cancer treatment is important. Artificial intelligence can analyse medical images and data to follow the recovery process of patients. This can be useful for detecting complications that need to be diagnosed early and evaluating response to treatment.

5. Data Integration and Big Data Analytics

Breast cancer diagnosis and treatment processes generate large amounts of data. Artificial intelligence can effectively analyse this data and guide medical professionals to make better decisions. It can also provide a broader perspective by integrating data from different hospitals and sources.

6. Conclusion

Artificial intelligence has significant potential in the field of breast cancer diagnosis, treatment and management. This technology can improve patients' chances of survival and help medical professionals make better decisions. However, it is also critical to consider ethical responsibilities when monitoring developments in this field.

Lesions suggestive of malignancy on breast imaging can be broadly classified as soft tissue lesions, microcalcifications or a combination of these. Therefore, several AI-based detection algorithms have been developed that identify or localise these lesion types and then analyse lesion characteristics to determine the likelihood of malignancy (10). It is also important to understand how to use these AI-based decision support systems. A suitable application would be for the radiologist to first interpret the examination without the help of AI and then interpret it with the help of AI (11). Dang et al. show that mammograms classified according to BI-RADS categories are obtained with better agreement with the expert radiologist when reading with the support of artificial intelligence (12).

Histopathological analysis of breast cancer remains at the forefront of AI-clinical integration, offering new scientific value and significantly higher reliability than human assessment. With the widespread application of whole slide images in breast pathological practice, the application of AI algorithms has become increasingly popular. The integration of AI algorithms into the digital workflow makes it possible to significantly improve pathologists' efficiency and diagnostic accuracy by reducing workload (e.g. repetitive

tasks such as lymph node metastasis detection) and diagnostic errors. Some AI algorithms can provide pathologists with new tools to address the resulting pathological assessment, such as measurement of tumour-infiltrating lymphocytes, prediction of treatment response and classification of recurrence risk. Furthermore, AI algorithms can complement or replace some expensive molecular tests such as Oncotype DX (Genomic Health, Redwood City, California) and genetic testing in breast pathology (13, 14).

After all, artificial intelligence will not immediately replace pathologists and radiologists, but it will certainly help health professionals in the coming years.

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Ethics

Informed Consent: The authors declared that informed consent form was signed by the patient.
Copyright Transfer Form: Copyright Transfer Form has been signed by the corresponding author
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