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LETTER

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The role of digital pathology and artificial intelligence-assisted analysis in breast cancer diagnosis

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Dear Editor,

Breast cancer is the most commonly diagnosed malignant cancer among women worldwide and poses a significant public health issue in terms of early detection and effective treatment. Therefore, the rapid and accurate diagnosis of breast cancer plays a crucial role in the treatment process. In addition to traditional pathology methods, the increased use of digital pathology has emerged as a new and powerful tool in this fight. Digital pathology allows for more precise, faster, and standardized evaluations in patient diagnosis processes, and this technology enhances the efficiency of pathologists, thereby improving the quality of healthcare services.

Digital pathology involves the digital scanning of specimen slides and the analysis of these images, providing speed, accuracy, and standardization to histopathological evaluations. While traditional pathological examinations can be time-consuming and sometimes subjective, digital pathology makes this process more objective. Especially in complex diseases like breast cancer, digital pathology is revolutionizing critical stages such as tumor subtyping, and the evaluation of prognostic and predictive markers (1,2). This process ensures that pathologists can reach clearer, more reliable, and accurate results.

Artificial intelligence (AI)-assisted algorithms further enhance the power of digital pathology. These algorithms can perform histopathological evaluations more

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quickly, accurately, and consistently. For example, the digital analysis of HER2 protein evaluation shows high agreement with manual scoring and provides a more accurate correlation with clinical outcomes (3). Furthermore, telepathology helps overcome geographic barriers among pathologists, creating opportunities for equal access to healthcare services, particularly in areas with a shortage of pathologists (4).

Digital pathology has several significant potential advantages that could revolutionize breast cancer diagnosis in the future. As artificial intelligence continues to develop, the costs of digital pathology are decreasing, and the technology is becoming more accessible across broader geographical areas. In particular, AI-assisted digital pathology may play a crucial role in addressing the shortage of pathologists in low- and middle-income countries (5,6). This development presents a significant opportunity to reduce global health inequalities.

AI-based systems, with their complex image processing algorithms, also significantly reduce error rates in the diagnostic process. For instance, algorithms that automatically detect tumor areas and classify tumors in tissue sections allow for the accurate detection of even small metastases that the human eye might miss (7). These systems help reduce the workload of pathologists while increasing diagnostic accuracy. Additionally, the reliability of these automated analyses plays a critical role in minimizing human error in healthcare services.

The contribution of digital pathology to efficiency and processing times is also noteworthy. AI-supported big data analysis enables a larger number of samples to be processed in a shorter time. This development not only reduces the workload in pathology laboratories but also contributes to the faster and more effective delivery of healthcare services (8). Particularly for fast-progressing diseases such as cancer, accelerating the diagnostic process shortens the time to begin treatment and increases patients' chances of recovery.

In conclusion, the development of digital pathology, particularly with the new opportunities presented by artificial intelligence, signifies an important paradigm shift in breast cancer diagnosis. In addition to offering more precise, faster, and accurate diagnosis, this technology makes it possible to provide equal healthcare services to a broader population. By making healthcare more accessible and minimizing errors in the diagnostic process, digital pathology stands out as a significant step in the fight against cancer. In this context, emphasizing the future role of digital pathology and raising awareness on this topic will greatly contribute to the development of new solutions in the battle against cancer.

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