EDITORIAL

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Role of Artificial Intelligence (AI) in improving Diagnostic Accuracy of Histopathology

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INTRODUCTION

Histopathology is an essential diagnostic technique for a number of diseases including cancer. It has been accepted worldwide as the gold standard for the diagnosis of neoplastic disorders.[1]

Since the middle of 20th century, the histopathology reports have been increased significantly in both the length and context and are becoming more complex. With the advancements in pathology, updated and more complex criteria are in practice for grading and staging systems, along with the comments on status of resection margins. There is an urge that the histopathologists should develop new methodologies for the documentation of this information.[2]

The commonly used stains in histopathology laboratory are Hematoxyline and Eosin (H&E). The H&E stained smears produce high resolution pictures that show critical morphological features of tumors when examined under the light microscope. However, the manual microscopic examination of H&E-stained slides is based on the expertise of pathologists, making it more time- consuming as well it depends upon the pathologist's knowledge and experience. To address these limitations, there is a growing interest in adopting advanced technologies, such as deep learning and computer image processing, to extract more information from pathological slides beyond routine diagnosis. Recent advancements made in deep learning for computational pathology have enabled the use of H&E-stained slides for automated detection of cancer, making differential diagnosis, diagnosing morphological variants and the prediction of patient survival.[3]

In recent years with evolutions in technology, AI automation has become a major advancement in healthcare. Artificial intelligence (AI) techniques are being developed at a rapid pace in histopathology and other diagnostic fields that use images like radiology.[4,5] Our capacity to extract quantitative data from digital histopathology images is increased by the application of AI algorithms. AI is predicted to improve pathology reports' objectivity and consistency, by revealing the hidden information in commonly available data, lessen the strain for human experts, and will have a clinical benefit.[6, 7]

In the era of artificial intelligence, machine learning (ML) and deep learning (DL), AI algorithms increase the ability of histopathologists to make more accurate and reliable diagnoses. Application of these technologies are making new advancements, including the ability to interpret complex patterns in the histology of breast cancers, expediting the time- consuming processes like detection of lymph node metastasis and scoring of predictive immuno histochemistry markers more efficiently and accurately. These advancements ultimately result in improved patient outcomes and more individualized treatment plans. Application of AI in breast cancers can help us from predicting the treatment results to automation of histopathology report analysis. The few applications of AI include automated scoring of antigen Kiel 67 (Ki-67), detection of metastasis in lymph nodes and counting the number of mitotic cells or cells positive for a certain marker, such as Programmed Death –Ligand 1(PD-L1).[8,9]

The most widely used form of histopathological data analysis is by whole slide digital images scanning (WSI).[10] Whole slide digital scanning and histopathological image analysis combined with artificial intelligence (AI) technology provide high resolution and high speed analysis and help the pathologists provide accurate results.[10] A study done at Agha Khan University Hospital on Ki-67 scoring showed a high concordance with a significant p-value between the manual and automated scoring methods.[11]

AI is revolutionizing the healthcare sector worldwide and is also gaining popularity in clinical laboratories in Pakistan. Recent efforts towards automation have improved lab procedures' accuracy and efficiency. Artificial intelligence is expected to bring about a new era of advancements.[12]

There is increasing need to develop a definitive framework to address ethical issue of AI in healthcare. AI technologies should be implemented in the ways that address patient autonomy, confidentiality, transparency and informed consent. Pathologists in Pakistan need to formulate guidelines considering the socio-cultural norms of society. The question of legal responsibility and accountability needs to be resolved before implementation of AI in imaging specilaities.[13]

Worldwide pathologists are showing positive attitude towards adopting AI techniques and it is becoming a need of the hour. Although AI has shown the capacity to improve the accuracy in diagnosis in specific areas of histopathology and also has improved the clinical workflow in the laboratories but lack of validation of data by the pathologists and wrong interpretation of results may pose problems.

AI has the potential to support the pathologists rather than replacing them. The pathologist's role will remain an

important factor in incorporating AI in laboratories even if these are completely automated with digital imaging and data base management. Pakistan lags behind in adoption of AI when compared to the regional countries such as India and United Arab Emirates. There is dire need to invest in infrastructure, develop skilled professionals and formulate regulatory frameworks. Accurate and timely diagnosis can save patients from undue treatments and can save resources. Adequate training and acquisition of skills of the pathologists is essential for the responsible use of AI in histopathology.[14]

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