Sharpening lung cancer diagnosis and treatment

At West China Hospital, researchers are creating a complete precision management system to treat lung cancer.

Lung cancer, the most commonly diagnosed cancer in China, has only a 19.7% five-year survival rate in the country. The disease in non-smokers is prevalent and younger patients account for an increasingly large proportion of cases, so a localized strategy for early screening and accurate diagnosis is paramount.

"We have developed an AI model to aid non-invasive diagnosis of lung cancer. Taking a multi-omics approach, our team maps molecular changes in lung cancer development and reveals biomarkers for early diagnosis and treatment," says Weimin Li, president of West China Hospital of Sichuan University and a professor at the Department of Respiratory and Critical Care Medicine.

Based on a dataset of more than 500,000 computerized tomography (CT) images, Li's team has trained an AI model to identify features such as ground-glass opacity — hazy gray areas that indicate increased density inside the lungs and nodules[1], a growth of abnormal tissue. The model achieved precise diagnosis of lung diseases with an accuracy rate above 90% in a retrospective study of participants with the disease.

Weimin Li and his team have trained an AI model to aid clinicians in early diagnosis and treatment of lung cancer.

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Approved by the National Medical Products Administration (NMPA), their AI model has been applied in numerous hospitals to aid clinicians in early diagnosis and treatment of lung cancer.

Li's team has also revealed the molecular characteristics of non-smoking lung cancer patients in China, and implemented a screening strategy using low-dose spiral CT scan for high-risk groups above the age of 40. They've initiated a programme to provide lifelong care and collaborative management for patients with lung nodules and lung cancer to improve early diagnosis and increase survival rate.

For early-stage non-small cell lung cancer (NSCLC), the most common type of lung cancer, the mainstay treatment is video-assisted thoracoscopic lobectomy — the anatomic resection of an entire lobe of the lung. However, recurrence and distant metastases are frequent after resection, often due to the presence of circulating tumour cells in peripheral blood.

Lunxu Liu, a professor at the Department of Thoracic Surgery and vice president of the hospital, has developed a technique called the single-direction thoracoscopic lobectomy. In a randomized clinical trial, Liu and his team demonstrated that tying the effluent veins first during operation may prevent tumour cells from shedding into effluent venous blood, thus reducing tumour cell dissemination[2].

Still, some tumour cells remain in the body after NSCLC treatment, posing a risk of relapse. This is known as the molecular residual disease (MRD). Liu has been studying the MRD, hoping that "by individualized and precise prediction of prognosis after surgery, we can identify patients who need adjuvant therapy and provide them with the most effective treatment."

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As for treating advanced NSCLC, You Lu, director of the Department of Thoracic Oncology, has pioneered the trial of the CRISPR-Cas9 technology. By knocking off the inhibitor gene *PD-1* in T cells, he disrupts the pathway by which tumour cells escape from the immune system. The team has conducted a phase I clinical trial to investigate the off-target rate with next generation sequencing and whole-genome sequencing[3].

The immune microenvironment and heterogeneity of lung cancer tumours are the major barriers to immunotherapy, explains Lu. "We are looking to improve the efficacy of T cell therapy while combining it with other treatment options including radiotherapy and chemotherapy to conquer these challenges," says Lu. ■

References

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3. Lu, Y., *et al. Nature medicine* 26.5 (2020): 732-740.