Article type: Expert Review

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The role of immunohistochemistry in differentiating lung tumors.

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Received: 10-Jun-2025, Manuscript No. AACPLM- 25-166890; **Editor assigned:** 11-Jun-2025, Pre QC No. AACPLM- 25-166890 (PQ); **Reviewed:** 20-Jun-2025, QC No. AACPLM- 25-166890; **Revised:** 21-Jun-2025, Manuscript No. AACPLM- 25-166890 (R); **Published:** 28-Jun-2025, DOI: 10.35841/ aacplm-7.2.261

Introduction

Immunohistochemistry (IHC) is a pivotal diagnostic tool in the differentiation of lung tumors, enabling pathologists to classify tumors accurately based on their cellular and molecular characteristics. Lung cancer, encompassing Non-Small Cell Lung Carcinoma (NSCLC) and Small Cell Lung Carcinoma (SCLC), presents diagnostic challenges due to overlapping histological features. IHC enhances diagnostic precision by using antibodies to detect specific antigens in tissue samples, aiding in distinguishing between tumor types, such as adenocarcinoma, squamous cell carcinoma, and neuroendocrine tumors, and guiding therapeutic decisions. [1].

NSCLC, which accounts for approximately 85% of lung cancers, includes adenocarcinoma and squamous cell carcinoma as the most common subtypes. IHC markers like Thyroid Transcription Factor-1 (TTF-1) and napsin A are highly specific for adenocarcinoma, with TTF-1 expressed in 70-80% of cases. Squamous cell carcinoma, conversely, is characterized by markers such as p40 and cytokeratin 5/6 (CK5/6) . These markers help differentiate subtypes when histological features are ambiguous, especially in small biopsies or poorly differentiated tumors. For instance, a tumor positive for TTF-1 and negative for p40 is likely adenocarcinoma, while the reverse suggests squamous cell carcinoma.[2].

SCLC, a high-grade neuroendocrine tumor, is identified using markers like chromogranin A, synaptophysin, and CD56. These markers distinguish SCLC from NSCLC and other neuroendocrine tumors, such as carcinoids, which may express similar markers but differ in staining intensity and clinical behavior. IHC also aids in identifying rare lung tumors, such as large cell neuroendocrine carcinoma, which shares features with both SCLC and NSCLC, requiring a panel of markers for accurate diagnosis. [3]

Beyond tumor classification, IHC plays a critical role in identifying actionable biomarkers. Programmed death-ligand (PD-L1) expression, assessed via IHC, predicts response to immune checkpoint inhibitors in NSCLC . Similarly, IHC for anaplastic lymphoma kinase (ALK) and ROS1 rearrangements identifies patients eligible for targeted therapies. These applications underscore IHC's role in precision medicine, where accurate tumor
typing and biomarker profiling guide treatment stra tegies.[4].

Challenges in IHC include variability in antibody sensitivity, tissue fixation effects, and interpretation subjectivity Standardized protocols and automated platforms have improved reproducibility, but pathologists must select appropriate marker panels tailored to clinical context . Additionally, integrating IHC with molecular techniques, such as next-generation sequencing, enhances diagnostic accuracy, especially in complex cases.[5].

Conclusion

IHC is indispensable in differentiating lung tumors, enabling precise classification and personalized treatment. Its ability to identify specific histological and molecular features ensures accurate diagnosis and informs therapeutic decisions, improving patient outcomes in lung canc er management.

Citation: Aarnio B. The role of immunohistochemistry in differentiating lung tumors. J Clin Path Lab Med.2025;(7)2:261

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