Advancements in the Application of Virtual Staining in Forensic Pathology

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Abstract

Background: Virtual staining is an advanced digital imaging technology. With the development of pathology in recent years, the application prospects of this technology are becoming increasingly widespread. At the same time, the progress of virtual staining in forensic pathology is receiving increasing attention. *Purpose:* This article mainly discusses the fields involved in virtual staining technology and its application in forensic pathology. Computer algorithms and digital image processing technology: able to simulate the effect of traditional staining techniques (such as H&E staining), thus providing more possibilities in the field of digital pathology. *Fields related to virtual staining:* Digital image processing: Virtual staining involves the acquisition, processing, and analysis of digital images. It requires understanding of the basic principles and techniques of digital image processing, as well as how to use image processing software for operation and processing. *Biological histology:* Virtual staining mainly simulates the staining effect of biological tissue samples, so it requires knowledge of histology, including the principles of different staining methods, the characteristics of staining effects, and the basic knowledge of tissue structure and cell morphology. Computer algorithms and artificial intelligence: Virtual staining technology usually utilizes computer algorithms and artificial intelligence technologies to process and analyze digital images, requiring understanding of related algorithms and technologies, as well as how to apply them to virtual staining. *Conclusion:* Virtual staining technology can help forensic workers observe and analyze histological samples more clearly. By simulating different staining effects, forensic workers can observe different tissue structures and cell morphologies on the same digital slide, thereby improving the accuracy and reliability of forensic identification. Virtual staining technology can also provide more personalized and customized staining effects. Traditional staining techniques may be limited by dyes, while virtual staining technology can customize staining effects according to specific needs and research purposes, providing more options for different pathological studies. Overall, the progress of virtual staining technology in forensic pathology provides new ideas and possibilities for pathological diagnosis, and is expected to further promote the development of digital pathology and improve the level and quality of forensic diagnosis.

Keywords

Virtual Staining, Forensic Pathology, Digital Imaging Technology