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Usage of Thin Preparation to Get Thyroid Fine Needle Aspiration Cytomorphology and Digital Cytopathology

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Abstract

The adaptation of digital workflow and Artificial Intelligence (AI) for cytopathology has been hindered by the high variability in the use of cytopathology preparation. ThinPrep and other liquid based preparations were designed with digitization in mind can be easily adapted for both digital pathology and future AI for cytopathology. This review commentary provides additional context to why adaptation of ThinPrep for cytopathology is a sound strategy for the future of cytopathology.

Keywords: Cytopathology; Artificial Intelligence; Thyroid

Description

The recently published study of thyroid fine needle aspiration of follicular adenoma in the "atypia of undetermined significance" Bethesda category using digital image analysis is an exercise of using digital image analysis technology as a tool to quantitatively measure morphologic features and predict outcomes [1]. The goal was not to build another computational algorithm to prove such work can be done. As artificial intelligence technologies continue to mature, it is assured that any algorithm can be developed to perform any morphologic assessment task. The problem lies in generalizability, or the ability of the algorithm to work beyond the original development data. This is a profound problem in cytopathology due to the diversity of cytopathology practice. Based on author's experience, thyroid alone could be evaluated on preparation types range from handmade smears, liquid based preparation, and cell block material. Handmade smears are the most challenging preparation type for digital cytopathology as additional variations can be introduced due to institutional or individual preference on stains and smearing methods [2]; cell blocks are usually stained for Hematoxylin and eosin stain but preparation methods can significantly vary.

Promoting the most sensible digital image analysis cytopathology preparation is the most conducive way to standardize preparations for cytopathology and prepare for a digital future. ThinPrep was originally designed to work as a companion cytopathology preparation for digital image analysis and it features a few qualities that make it a top runner [3]. It is designed to be a monolayer preparation, reducing the need for z-stacking and the logistical burden on digital infrastructure [4,5]; it is prepared with standardized methods and instrumentation, minimizing batching variation; although sometimes controversial, the preparation method alters some background elements, such as cellular debris, while enhancing cytomorphology. ThinPrep is also more monolayer than other liquid based preparation such as sure path. It is accepted at many institutions as a stand-alone cytology preparation for a cytology specimen. ThinPrep not only lessens the need for Z-stack, algorithms designed for it is more likely to generalize across different institutions.

The study also hints that developing digital image analysis algorithm can be beyond simply replicating the skills of a trained cytopathologist. Quantitative measurement of cytomorphology, especially on a cytopathology preparation with a low pre-analytical variation, can yield additional understanding of disease process. Quantitative morphometric analysis in cytopathology is currently limited by both the lack of standardization of cytopreparation and the lack of computational tool. ThinPrep can serve the ideal cytopathology preparation for the development of computational cytopathology beyond the traditional manual morphologic examination.

To further elucidate the point, a potentially more ambitious study to prove the potential power of generalizability of digital image analysis algorithm developed on ThinPrep is needed.

Competing Interests

The authors declare that they have no competing interests.

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