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EDITORIAL

Advancing diagnostic hematopathology: pigeons or pixels?

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Levenson and colleagues recently demonstrated that pigeons (*Columba livia*) could distinguish between relatively straightforward benign and malignant breast tissue on digitally scanned hematoxylin and eosin-stained 5-μm sections of formalin fixed, paraffin-embedded breast (at a maximum resolution of 20×) at different levels of magnification after training with food reinforcement [1]. Single pigeons made 85% correct choices following 15 days of training; however, a cohort of four birds achieved a group accuracy level of 99%. Of course, these results do not suggest that diagnostic pathologists can be replaced by a flock of pigeons.

On the other hand, an emerging disruptive technology that pathologists need to embrace for augmenting work-flow standardization and efficiency, diagnostic accuracy and reproducibility, and practice quality and patient safety is digital pathology using whole slide imaging (WSI) systems. There is a body of literature that already shows that digital pathology is equivalent to standard light microscopy for diagnostic accuracy in surgical pathology, and that, with appropriate training and experience among the study pathologists, it can be accomplished without a significant lengthening of case turn-around-time [2, 3]. Digital pathology by WSI is now being used for primary surgical pathology diagnostics in several European countries, Singapore, Canada, and Japan [2]. Opportunities for using this technology now exist in the USA since the recent approval of the Phillips IntelliSite Pathology Solution by the US Food and Drug Administration for primary surgical pathology diagnosis [4]. Individual institutions must decide if implementing this technology is to their benefit [3, 5].

But what about hematopathology? Our field is one of the areas regarded as having limited studies on the use of digital pathology on WSI [6]. Some of these published studies include quantification of fibrosis and osteosclerosis in myeloproliferative neoplasms [7], estimates of adult bone marrow biopsy cellularity [8], and evaluation of MYC protein expression by immunohistochemistry [9]. By applying deep machine learning with a convolutional neural network algorithm, a recent study provided a proof-of-concept for a lymphoma diagnostic model [10]. Deep learning to develop diagnostic algorithms for digital hematopathology will be a significant future endeavor.

Like cytopathology, additional technical challenges are encountered in some aspects of digital hematopathology not faced in surgical pathology. High magnification, such as with oil immersion objectives, requires multi-planar scanning and z-stacking of images [5]. When this has been applied to hematopathology tumor boards, there appears to be considerable satisfaction [11].

Now, back to breast pathology, a recent study using digital pathology for the primary diagnosis of breast pathology specimens by three specialty breast pathologists showed complete clinical concordance between glass slide and digital impressions in 98.8% of cases [12]. While a reassuring result when compared to the pigeons, the study did not state whether or not the participants received food reinforcement.

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