



Automated classification of inflammation in colon histological sections based on digital microscopy and advanced image analysis

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Abstract

Introduction: Automated and quantitative histological analysis can improve diagnostic efficacy in colon sections. Our objective was to develop a parameter set for automated classification of aspecific colitis, ulcerative colitis, and Crohn's disease using digital slides, tissue cytometric parameters and virtual microscopy.

Methods: Routinely processed hematoxylin-and-eosin-stained histological sections from specimens that showed normal mucosa (24 cases), aspecific colitis (11 cases), ulcerative colitis (25 cases), and Crohn's disease (9 cases) diagnosed by conventional optical microscopy were scanned and digitized in high resolution (0.24 um/pixel). Thirty-eight cytometric parameters based on morphometry were determined on cells, glands, and superficial epithelium. Fourteen tissue cytometric parameters based on ratios of tissue compartments were counted as well. Leave-one-out discriminant analysis was used for classification of the samples groups.

Results: Cellular morphometric features showed no significant differences in these benign colon alterations. However, gland related morphological differences (Gland Shape) for normal mucosa, ulcerative colitis, aspecific colitis were found ($p < 0.01$). 8 of the 14 tissue cytometric related parameters showed significant differences ($p < 0.01$). The most discriminatory parameters were the ratio of cell number in glands and in the whole slide, biopsy/gland surface ratio. These differences resulted in 88% overall accuracy in the classification. Crohn's disease could be discriminated only in 56%

Conclusions: Automated virtual microscopy can be used to classify colon mucosa as normal, ulcerative colitis, and aspecific colitis with reasonable accuracy. Further development of dedicated parameter's are necessary to identify Crohn's disease on digital slides.

