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DEVELOPMENT AND VALIDATION OF AN AUTOMATED SYSTEM FOR ASSESSMENT OF LIVER STEATOSIS AND FIBROSIS IN ROUTINE

HISTOLOGICAL IMAGES IN PATIENTS WITH NON-ALCOHOLIC FATTY LIVER DISEASE

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Introduction: Liver biopsy is the gold standard method for diagnosing and staging NAFLD, up to date, the steatosis grade and fibrosis stage are reported using semi-quantitative scores with high inter-observer variability. We aimed to develop an automated method for steatosis and fibrosis quantitation using routine histological images of NAFLD patients.

Method: 118 consecutive patients with biopsy-confirmed NAFLD were retrospectively evaluated. Biopsies were stained with H&E and Sirius red, and then scored by two histopathologists. Each image was then analysed by the automated software in two stages: Machine learning clustering and Morphological Image Processing (Figure 1). Fat % and fibrosis % computed by the software were compared with the manual annotation for all cases.

Results: There was good correlation between fat% and steatosis grade but with significant overlap between groups: Anova 50.9, $p < 0.001$ (Figure 2a) grade 0: fat 0.6%(0-3), grade 1: 7.5%(1-22), grade 2: 12.5%(2.5-29), grade 3: 20.8%(11.5-32). Results were similar between fibrosis% and fibrosis stage: Anova 42.9, $p < 0.001$ (Figure 2b) stage 0: 2.5%(1-4), stage 1: 3.3%(1-9), stage 2: 4.9%(2-9), stage 3: 7.9%(3-13), stage 4: 17.3%(8-30).

Image/graph:

Conclusion: Our fully automated software uses low-resolution images widely available and shows excellent correlation with experts' annotation. There is wide variation in both fat and fibrosis quantitation within each grade and stage with considerable overlap. Computerised quantitative assessment produces more objective measurements which increase the sensitivity to show response to interventions.

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