Abstract #2164

AI-powered Whole-slide Image Analysis of Tumor Infiltrating Lymphocytes for Prediction of Prognosis in Colorectal Cancer

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*** The presenting author has no conflicts of interest to declare**

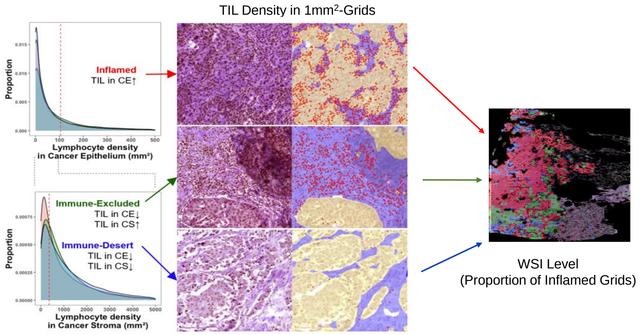
Background

The degree of T-cell infiltration has been suggested as an important prognostic biomarker for colorectal cancer (CRC) patients, regardless of other clinical and/or pathological factors. In this study, we analyzed tumor infiltrating lymphocyte (TIL) counts of CRC using Lunit SCOPE IO, an artificial intelligence (AI)-powered whole slide image (WSI) software analyzer. Our aim was to analyze the prognostic significance of AI-powered TIL analysis in CRC.

Methods

- H&E images, sequencing data and survival data of Stage I-III CRC patients from The Cancer Genome Atlas (TCGA) were utilized for analysis.
- Definition of Inflamed Score (IS):
  - Tumor-containing WSI were divided into 1mm^2-sized tiles
  - IS was defined as the proportion of all 1mm^{2}sized tiles within a WSI having an inflamed immune phenotype (having cancer epithelial TIL counts over a predefined threshold).

$$\text{inflamed score} = \frac{\text{N of inflamed grids}}{\text{(N of inflamed + excluded + desert grids)}}$$



AI-powered TIL Analyzer Demo

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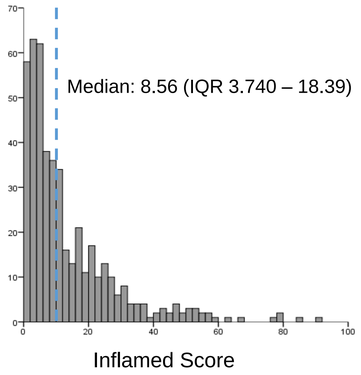
Results

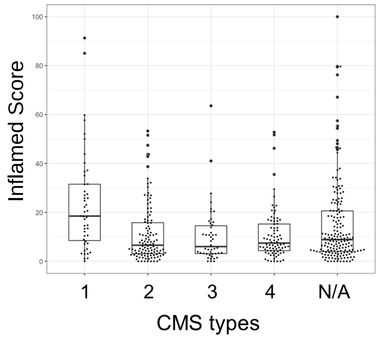
1. Patient characteristics and IS distribution (N=461)

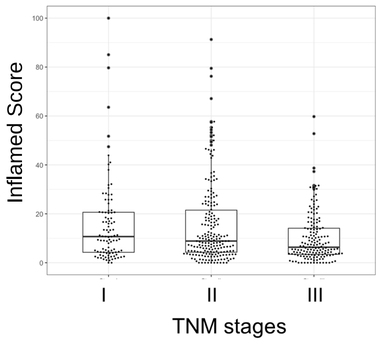
	# Patients (%)
Age, median (range)	68 (31 – 90)
Male/Female	233/228 (50.5 %/49.5 %)
Colon/Rectum	345/116 (74.8 %/25.2 %)
Stage	
I	98 (21.2 %)
II	201 (43.6 %)
III	162 (35.1 %)
Microsatellite instability (MSI)	
Stable or Low	351 (76.1 %)
High	77 (16.7 %)
Unknown	33 (7.2 %)



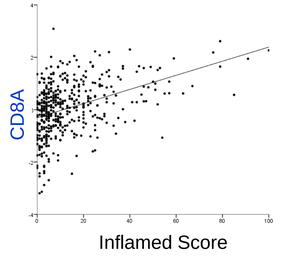
2. Correlation between inflamed score (IS) and CMS type, TNM stages, and immune cell expression levels

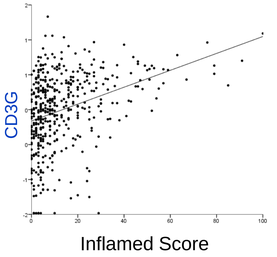
- The IS was higher in CMS1 group compared to CMS 2 – 4 groups (median 18.49 vs. 6.90, p < 0.001). No significant differences in IS was observed across TNM stages.

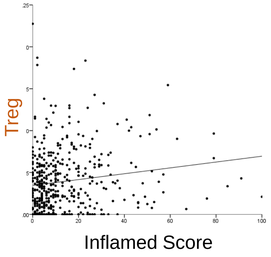




- IS showed moderate positive correlations with CD8A (rs = 0.422, p < 0.001) and CD3G (rs = 0.377, p < 0.001) expression levels but weaker positive correlations with regulatory T cells (Treg) (rs = 0.162, p < 0.001), TH1 (rs = 0.209, p < 0.001) or TH2 cell proportions (rs = 0.128, p = 0.006).

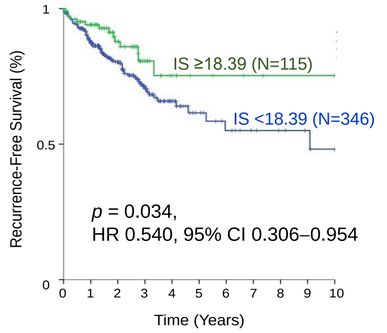




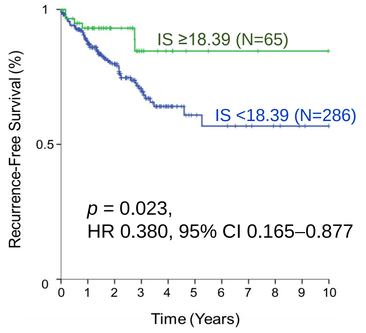


3. AI-powered analysis of TIL in WSI can provide prognostic information in stage I-III CRC

- The recurrence-free survival (RFS) of the patients with IS higher than 3rd quartile (≥18.39) were significantly longer compared to the lower group (p = 0.034, HR 0.540, 95% CI 0.306 – 0.954). The same outcome was observed in cases with MSS tumors (p = 0.023, HR 0.380, 95% CI 0.165 – 0.877).



All cases (N=461)



MSS CRC (N=351)

Conclusion

- AI-powered analysis of WSI can provide prognostic information in stage I-III CRC patients.
- Further development of AI-powered TIL analysis including the spatial information of TIL in relation to tumor cells may improve prognostic power.