A VIRTUAL CHROMOENDOSCOPY ARTIFICIAL INTELLIGENCE SYSTEM TO DETECT ENDOSCOPIC AND HISTOLOGIC REMISSION IN ULCERATIVE COLITIS

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**Background**
Endoscopic and histologic activity are important therapeutic targets in ulcerative colitis (UC). The Paddington International Virtual ChromoendoScopy ScOre (PICaSSO)1 demonstrated that enhanced visualization of subtle mucosal and vascular inflammatory changes correlated strongly with histology. However, without adequate training, the subjective evaluation of white light (WL) and VCE endoscopic scores varies between observers. We aimed to develop an artificial intelligence (AI) system for objective assessment of endoscopic disease activity and predict histology related to both white light and VCE videos.

**Methods**
559 endoscopy videos (67280 frames) from 302 patients representative of all grades of inflammation, from our prospective PICaSSO multicentre study1 were used to develop a convolutional neural network (CNN). 316 videos were divided into training (254) and validation (62) sets. 243 additional videos (122 patients) were used as test cohort. The videos were edited to separate clips with WL and with VCE, and assessed using Ulcerative Colitis Endoscopic Index of Severity (UCEIS) and PICaSSO, respectively. The classification stage of a pre-trained ResNet50 CNN classifier was trained to predict the healing or active inflammation on video frames. One network was trained to predict endoscopic remission (ER) as UCEISÂ‰¤1 from WL frames, and a second network was trained to predict PICaSSOÂ‰¤3 from VCE. Figure 1 Histological remission (HR) was defined as Robarts Histological Index (RHI) Â‰¤3 with no neutrophils in lamina propria or epithelium.

**Results**
In the validation cohort, our system predicted ER (UCEIS Â‰¤1) in WL videos with 82% sensitivity (Se), 94% specificity (Sp), and an area under the ROC curve (AUROC) of 0.92. For the detection of remission in VCE videos (PICaSSO Â‰¤3) Se was 74%, Sp 95%, and AUROC 0.95. In the testing cohort of independent videos, the diagnostic performance for both cut offs of ER remained similar. Table 1

Our system also had an excellent diagnostic performance for the prediction of HR in the validation set, with Se, Sp, and Accuracy of 92%, 83%, and 85% respectively, using VCE, and 83%, 87%, and 86% respectively, with WL. In the testing set performance declined modestly while remaining good. Of note, the algorithm's prediction of histology was similar in VCE and WL videos. Table 1

**Conclusions**
Our AI system accurately recognizes ER in videos and predicts HR equally well. This is the first AI model developed to analyze inflammation and ER in VCE through the PICaSSO score, and the first multi-domain system providing a complete endoscopic and histologic assessment.

**Reference**
1. Iacucci et al. Gastroenterology 2021