Artificial intelligence identifies and quantifies colonoscopy blind spots

Some mucosal surfaces on folds and within haustra may not be visualized at all during colonoscopy, and thus precancerous lesions are missed. We describe here preliminary results of an artificial intelligence (AI) technology that identifies and quantifies these “blind spots,” with the aim, potentially, that endoscopists may be directed to them in real time. Anonymized colonoscopy videos were acquired from a single endoscopist with a high (47%) adenoma detection rate (ADR), using Olympus CF and PCF devices (Olympus USA, Valley Forge, Pennsylvania, USA) and high definition recording (Epiphain, Palo Alto, California, USA). The main AI modalities applied were a recurrent neural network (an AI type particularly suitable for sequential data), that had been trained to compute depth [1, 2] combined with visual simultaneous localization and mapping (SLAM) [3].

The AI software was applied to 76 colonoscopy video sequences from 18 patients, showing colon segments of 4–25 cm in length. This created three-dimensional (3D) reconstructions of the colon segments and then identified blind spots, showing as holes or gaps in the reconstructions, and quantified these non-visualized areas. The study endoscopist reviewed the reconstructions and validated that the blind spots had not been seen in the colonoscopy video. The last 12 3D reconstructions were done in real time with the video sequence; these were 2–6 seconds in duration, corresponding to colon lengths of 7–25 cm (median 10 cm).

▶ Video 1 shows a colonoscopy video alongside the real-time reconstruction highlighting a blind spot. ▶ Fig. 1 is an example of a reconstructed segment of colon with no blind spot, while ▶ Fig. 2 shows a sequence of video images where

▶ Fig. 1 Al-reconstructed segment of the colon with no blind spot.
the left wall of the colon was not visualized because of the camera angle, and the reconstructions with corresponding gaps.

Our system calculated that among the 76 reconstructed segments, the blind spots ranged from 1% to 50% of the total surface area (interquartile range 8.7%–27%), with a median 19% of surface area being missed despite the high ADR of the operator. ▶ Fig. 3 shows the distribution of the differing missed area percentages among the 76 reconstructed colonic segments.

Endoscopy_UCTN_Code_TTT_1AQ_2AB

Funding

McGill Sarah K et al. Artificial intelligence detects colonoscopy gaps... Endoscopy | © 2021. Thieme. All rights reserved.
Video 1 Artificial-intelligence identification and quantification of colonoscopy blind spots. The video shows the colonoscopy video (left) and real-time reconstruction (center and right) which highlights the blind spot in the colon wall.

Competing interests

All authors are patent holders. Sarah K. McGill and Julian Rosenman have received research funding from Olympus.

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Endoscopy
DOI 10.1055/a-1346-7455
ISSN 0013-726X
published online 2021
© 2021. Thieme. All rights reserved.
Georg Thieme Verlag KG, Rüdigerstraße 14, 70469 Stuttgart, Germany

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