Die diskutierten Studien aus Mailand, zuletzt GUT

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Artificial intelligence and colonoscopy experience: lessons from two randomised trials

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Abstract

Background and aims: Artificial intelligence has been shown to increase adenoma detection rate (ADR) as the main surrogate outcome parameter of colonoscopy quality. To which extent this effect may be related to physician experience is not known. We performed a randomised trial with colonoscopists in their qualification period (AID-2) and compared these data with a previously published randomised trial in expert endoscopists (AID-1).

Methods: In this prospective, randomised controlled non-inferiority trial (AID-2), 10 non-expert endoscopists (<2000 colonoscopies) performed screening/surveillance/diagnostic colonoscopies in consecutive 40-80 year-old subjects using high-definition colonoscopy with or without a real-time deep-learning computer-aided detection (CADe) (GI Genius, Medtronic). The primary outcome was ADR in both groups with histology of resected lesions as reference. In a post-hoc analysis, data from this randomised controlled trial (RCT) were compared with data from the previous AID-1 RCT involving six experienced endoscopists in an otherwise similar setting.

Results: In 660 patients (62.3±10 years; men/women: 330/330) with equal distribution of study parameters, overall ADR was higher in the CADe than in the control group (53.3% vs 44.5%; relative risk (RR): 1.22; 95% CI: 1.04 to 1.40; p<0.01 for non-inferiority and p=0.02 for superiority). Similar increases were seen in adenoma numbers per colonoscopy and in small and distal lesions. No differences were observed with regards to detection of non-neoplastic lesions. When pooling these data with those from the AID-1 study, use of CADe (RR 1.29; 95% CI: 1.16 to 1.42) and colonoscopy indication, but not the level of examiner experience (RR 1.02; 95% CI: 0.89 to 1.16) were associated with ADR differences in a multivariate analysis.

Conclusions: In less experienced examiners, CADe assistance during colonoscopy increased ADR and a number of related polyp parameters as compared with the control group. Experience appears to play a minor role as determining factor for ADR.

Trial registration number: NCT:04260321.

Keywords: adenoma; artificial Intelligence; colonoscopy; colorectal cancer; screening.

Randomized Controlled Trial › Gastroenterology. 2020 Aug;159(2):512-520.e7.
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Efficacy of Real-Time Computer-Aided Detection of Colorectal Neoplasia in a Randomized Trial

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Abstract

Background & aims: One-fourth of colorectal neoplasias are missed during screening colonoscopies; these can develop into colorectal cancer (CRC). Deep learning systems allow for real-time computer-aided detection (CADe) of polyps with high accuracy. We performed a multicenter, randomized trial to assess the safety and efficacy of a CADe system in detection of colorectal neoplasias during real-time colonoscopy.

Methods: We analyzed data from 685 subjects (61.32 ± 10.2 years old; 337 men) undergoing screening colonoscopies for CRC, post-polypectomy surveillance, or workup due to positive results from a fecal immunochemical test or signs or symptoms of CRC, at 3 centers in Italy from September through November 2019. Patients were randomly assigned (1:1) to groups who underwent high-definition colonoscopies with the CADe system or without (controls). The CADe system included an artificial intelligence-based medical device (GI-Genius, Medtronic) trained to process colonoscopy images and superimpose them, in real time, on the endoscopy display a green box over suspected lesions. A minimum withdrawal time of 6 minutes was required. Lesions were collected and histopathology findings were used as the reference standard. The primary outcome was adenoma detection rate (ADR, the percentage of patients with at least 1 histologically proven adenoma or carcinoma). Secondary outcomes were adenomas detected per colonoscopy, non-neoplastic resection rate, and withdrawal time.

Results: The ADR was significantly higher in the CADe group (54.8%) than in the control group (40.4%) (relative risk [RR], 1.30; 95% confidence interval [CI], 1.14-1.45). Adenomas detected per colonoscopy were significantly higher in the CADe group (mean, 1.07 ±1.54) than in the control group (mean 0.71 ± 1.20) (incidence rate ratio, 1.46; 95% CI, 1.15-1.86). Adenomas 5 mm or smaller were detected in a significantly higher proportion of subjects in the CADe group (33.7%) than in the control group (26.5%; RR, 1.26; 95% CI, 1.01-1.52), as were adenomas of 6 to 9 mm (detected in 10.6% of subjects in the CADe group vs 5.8% in the control group; RR, 1.78; 95% CI, 1.09-2.86), regardless of morphology or location. There was no significant difference between groups in withdrawal time (417 ± 101 seconds for the CADe group vs 435 ± 149 for controls; P = .1) or proportion of subjects with resection of non-neoplastic lesions (26.0% in the CADe group vs 28.7% of controls; RR, 1.00; 95% CI, 0.90-1.12).

Conclusions: In a multicenter, randomized trial, we found that including CADe in real-time colonoscopy significantly increases ADR and adenomas detected per colonoscopy without increasing withdrawal time. ClinicalTrials.gov no: 04079478.

Keywords: Adenoma Per Colonoscopy; Artificial Intelligence; Comparison; Early Detection.

Es gibt bereits 12 Metaanalysen zu diesem Thema, mehr als randomisierte Studien

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Abstracts aus der Gruppe von Prof. Meining

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Development and evaluation of a deep learning network to recognize different interventions during colonoscopy

Abstract

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10.2.: Endoscopy, colon

Artificial intelligence for polyp detection during colonoscopy (CADe) presents its benefit during the withdrawal phase of the procedure by visualizing a fully insufflated colon lumen. The introduction of a snare or biopsy forceps through the working channel of the endoscope often leads to the generation of mucosal folds. The instrument and the folds are then often false positively recognized as polyps by the CADe. This happens mostly during interventions like polypectomy. Those appearing bounding boxes have the potential to disturb the examiner.

In this work, we aim to develop and evaluate a convolutional neuronal network (CNN) that is able to recognize instruments in the endoscopic image and pause the CADe. Thus, reduce the rate of false positive or disturbing detections.
In total 21864 images from ten colonoscopy videos with interventions like biopsies and polypectomy were analyzed for visible instruments and false positive detections by a commercially available CADe (GI-Genius) during that time points. A CNN was developed using those ten videos and was evaluated on a dataset of additional 6 videos with polypectomies.

The training data contained 15379 (70.3%) images with visible instruments. The CNN was able to recognize instruments in 94.2% of the training data set images. Using the validation data set the CNN was able to detect 93.7% of the images with instruments correctly. This resulted in a reduction of disturbing detections when an instrument is present of 94.1%, accounting for a mean of 161.5 disturbing frames per colonoscopy.

CADe often relies on clean and well-insufflated colon lumen to detect polyps. Instruments like polypectomy snares often lead to false positive or disturbing detections on the screen. The presented CNN in this work is able to accurately detect if an instrument is present on the endoscopic image and pause the CADe system. This might potentially help the examiner to concentrate on the intervention instead of on multiple appearing bounding boxes.

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Artificial intelligence for polyp detection during colonoscopy – an in-depth analysis of a commercially available system

Abstract

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10.2.: Endoscopy, colon

Artificial intelligence (AI) using deep learning methods for polyp detection (CADe) already reached clinical practice. But besides the benefit of higher polyp detection rates (PDR) several limitations like a marked number of false positive detections limit its usability. Furthermore, AI studies indicate differing sensitivity related to polyp morphology.

The aim of the present study was to evaluate the influence of an in Europe commercially available CADe (GI-Genius) on PDR and the withdrawal time. Further, we aimed to do an in-depth analysis of the CADe performance using each single video-frame. Full-HD videos of two groups were analyzed after exclusion of examinations not meant for polyp detection: routine colonoscopies with CADe support (March to April 2020) vs. previously recorded colonoscopies (March to April 2019, without CADe) with subsequent CADe analysis of recorded videos. PDR, withdrawal time and several other CADe performance measurements were analyzed in each group. ClinicalTrials.gov Identifier: NCT04335318.

More polyps per colonoscopy were found in the 57 examinations of the CADe group in comparison to the 54 examinations performed without CADe, but the difference was statistically not significant (1.26 vs. 0.91, p=0.22). Additionally, the PDR presented no difference between the two groups (0.51 vs. 0.44, p=0.63). In contrast, the withdrawal time without time spent on biopsies or polyp removal was significantly higher in the CADe group (520s vs. 391s, p<0.005). The post-hoc video analysis presented that the CADe system recognized all of the polyps identified by the examiner (n=115) and three additional ones. Analysis of the CADe detection performance regarding all single images with a visible polyp (temporal coherence) revealed that flat lesions (Paris 0-IIa) were significantly less recognized in 37.5% of images in comparison to protruding lesions (Paris 0-Ip / Is; 73.8% / 58.9%, p<0.01). There was a mean of 101 false positive detections of the CADe per colonoscopy. Most of those detections (75%) were of a short duration of less than 133ms.

In this retrospective study, the commercially available CADe increased the number of identified polyps per colonoscopy not-significantly at the cost of a prolonged withdrawal time. Additionally, the relevant number of short false positive detections and the low detection rates of flat polyps indicate the need for further improvement of the system.