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ACG will send a link to a CME & MOC evaluation to all attendees on the live webinar.

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If you plan to claim MOC Points for this activity, you will be asked to: Please list specific changes you will make in your practice as a result of the information you received from this activity.

Include specific strategies or changes that you plan to implement. THESE ANSWERS WILL BE REVIEWED.
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Week 2 – Thursday, January 12, 2023
How Can We Close the Screening Disparity Gaps in Our Population?
Faculty: Renee L. Williams, MD, MHPE, FACP
Moderator: Loren G. Rabinowitz, MD
At Noon and 8pm Eastern

Week 3 – Thursday, January 19, 2023
Cannabis for Gastrointestinal Disorders: Everything You Wanted to Know, But Were Afraid to Ask
Faculty: Linda Anh Nguyen, MD
Moderator: Steven Carpenter, MD, FACP
At Noon and 8pm Eastern

Visit gi.org/ACGVGR to Register
Disclosures

Seth A. Gross, MD, FACC
Ambu: Consultant; Ankon: Consultant; Colowrap: Consultant; Cook: Consultant; Microtech: Consultant; Motus: Consultant; Olympus: Consultant; Pentax: Consultant

Nasim Parsa, MD
Satisia Health: Advisory Committee/Board Member; Stock Options

*All of the relevant financial relationships listed for these individuals have been mitigated

Artificial Intelligence (AI) in GI Endoscopy

Seth A. Gross, MD, FACC
Professor of Medicine
NYU Grossman School of Medicine
Clinical Chief of Gastroenterology and Hepatology
NYU Langone Health
Objectives

- Discuss the value of artificial intelligence (AI)
- Review areas where AI is being applied clinically
- Go through the data for AI in colonoscopy

Background

- Artificial intelligence (AI) continues to grow with a key goal to improve overall quality in clinical practice
- Imaged-based specialties, such as endoscopy have the most to gain
- Once technique correction is maximized for the endoscopist AI may help address clinical pain points
**Terminology**

<table>
<thead>
<tr>
<th>Artificial intelligence</th>
<th>Umbrella term summarizing computer models based on human intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine learning</td>
<td>Subset of artificial intelligence for recognition of patterns in complex data</td>
</tr>
<tr>
<td>Deep learning</td>
<td>Subset of machine learning with automatic classification into output groups</td>
</tr>
</tbody>
</table>

Adapted from Hosny Am J Gastro et al 2018

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**Performance**

- **Early efforts**: AI with subhuman performance is occasionally used in commercial expert systems with varying degrees of utility
- **Current state**: Narrow task-specific AI has started to match and, in some instances, exceed human performance in tasks including conversational speech recognition, driving vehicles, playing Go and classifying skin cancer
- **Future outlook**: General AI exceeds human performance and reasoning in complex tasks, including writing best-selling novels and performing surgery. Human intelligence improves as we learn from AI

Adapted from Hosny Am J Gastro et al 2018
AI Applications in Health Care

- Robotics
- Image analysis
- Voice recognition
- Natural language processing
- Big data analysis
- Clinical pathways
- Statistical analysis
- Predictive modeling
Goals of Applying of AI in Gastroenterology

- Analyze relationships between prevention or treatment techniques and patient outcomes
  - Increase quality
  - Improve diagnostic accuracy
  - Decrease variance of health care delivery
  - Enhance outcomes
  - Decrease medical costs

The greatest value add for AI could be for the non-expert

For instance, identifying the abnormality of high grade dysplasia in a segment of Barrett's esophagus
Improving Upper Endoscopy Quality

- Barrett’s Esophagus
  - Challenge:
    - Identifying dysplasia and cancer

- Esophageal Squamous Cell Carcinoma
  - Challenge:
    - Often need Lugol staining

Surveillance of BE

- Non-adherence to Seattle protocol may lead to a significant decrease of dysplasia detection

- Many studies show that the adherence to Seattle protocol is low
  - 16% (CGH 2018; 16:862-869)
  - 24% (EIO 2018; 6: E300-E307)

- A recent meta-analysis showed a modest benefit of surveillance

CGH 2009;7:736-742
Gastro 2018;154:2068-2086
AI Assisted Barrett’s Surveillance Procedure

Ability to Detect Non-Dysplastic and Dysplastic Barrett’s Esophagus

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>P value</th>
<th>Specificity</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI diagnosis by WLI</td>
<td>98.6% (144/146)</td>
<td>0.023</td>
<td>88.8% (95/107)</td>
<td>0.0007</td>
</tr>
<tr>
<td>AI diagnosis by NBI</td>
<td>92.4% (73/79)</td>
<td></td>
<td>99.2% (125/126)</td>
<td></td>
</tr>
<tr>
<td>AI diagnosis by standard focus</td>
<td>96.6% (141/146)</td>
<td>0.89</td>
<td>89.9% (96/109)</td>
<td>0.005</td>
</tr>
<tr>
<td>AI diagnosis by near focus</td>
<td>96.2% (76/79)</td>
<td></td>
<td>98.4% (122/124)</td>
<td></td>
</tr>
<tr>
<td>Comprehensive AI diagnosis</td>
<td>96.4% (217/225)</td>
<td></td>
<td>94.2% (220/233)</td>
<td></td>
</tr>
</tbody>
</table>

AI Identifying a Squamous Cell Dysplasia

Sensitivities For Detecting SCC

Hiromu Fukuda, MD,1 Ryu Ishihara, MD,1 Yusuke Kato, PhD2

American College of Gastroenterology

GASTROINTESTINAL ENDOSCOPY Volume 92, No. 4 : 2020
Molecular biomarkers to detect changes in the context of tissue structure prior to morphologic changes.

Biomarkers and Spatial biology

Vision systems that objectively and reproducibly analyze and interpret tissue structures and features.

Digital Microscopy

A risk classifier trained on a large data set to recognize progressor vs non-progressor tissue samples.

Artificial Intelligence

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>5-year Probability of Progression (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>0%</td>
</tr>
<tr>
<td>High Risk</td>
<td>15%</td>
</tr>
</tbody>
</table>

Progression Score

5-year Probability of Progression (%)
How does TissueCypher work?

Multiplexed Fluorescence Labeling & Imaging of 9 Biomarkers & Nuclei

Quantitative Image Analysis

Risk Classification

15 Features Scaled & Weighted*

Risk Score*


Predicts Incident Progression in Patients with Non-Dysplastic BE

- Prediction of incident progression (> 2 years after endoscopy) in 76 patients with NDBE
- NDBE patients were at 5.9-fold increased risk compared to patients who scored low-risk
- A subset of patients with NDBE who progress at a higher rate (6.9%/year) than patients with expert-confirmed LGD
- The test identified 50% of incident progressors to HGD/EAC at the NDBE stage

Wide-Area Transepithelial Tissue Sampling with computer-assisted 3D analysis WATS

Wide area tissue sampling
* Samples ~90% of at-risk mucosa
* Procedure time less than 5 minutes

3D imaging analysis & AI/Machine learning
* Performs extended depth of field (EDF) analysis and produces 3D images of atypical epithelium
* Screens, identifies, and ranks atypical epithelium for pathologist

Screens, identifies, and ranks atypical epithelium for pathologist
- Decreases pathology misses
- Increases Interobserver agreement

Diagnosis made by pathologist utilizing computer synthesized 3D images of ranked atypical epithelium combined with microscopic analysis of brush acquired formalin fixed and PAP-stained slides
Artificial Neural Network Analysis

- Screens, identifies, and ranks atypical epithelium for pathologist
- Decreases pathology misses
- Increases Interobserver agreement

Diagnosis made by pathologist utilizing computer synthesized 3D images of ranked atypical epithelium combined with microscopic analysis of brush acquired formalin fixed and PAP-stained slides

Multicenter Prospective Randomized Trial

(16 centers, 160 cases)

- WATS3D detected an additional 23 HGD/EAC
- Prior Pathology
  - 13 High-Grade Dysplasia
  - 6 Low-Grade Dysplasia
  - 2 Indefinite
  - 2 Non-Dysplastic Barrett’s

Vennalaganti et al. Gastrointest Endosc. 2018;87(2):348-355
Gastric Cancer

- Challenge
- Differentiating cancerous and non-cancerous lesions
- Optical detection of HP
- Gastric ulcer

Diagnostic performance of the CAD system for gastric cancer and noncancer

<table>
<thead>
<tr>
<th>Experience in endoscopy (years)</th>
<th>Accuracy, % (95% CI)</th>
<th>P value vs CAD</th>
<th>Sensitivity, % (95% CI)</th>
<th>P value vs CAD</th>
<th>Specificity, % (95% CI)</th>
<th>P value vs CAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expert 1 &gt;10</td>
<td>85.1 (79.0-92.6)</td>
<td>&gt;.0001*</td>
<td>87.4 (78.9-92.8)</td>
<td>.0833</td>
<td>82.8 (71.5-93.3)</td>
<td>.2568</td>
</tr>
<tr>
<td>Expert 2 5-10</td>
<td>87.9 (82.3-92.0)</td>
<td>.4233</td>
<td>85.1 (76.1-91.1)</td>
<td>.6374</td>
<td>90.8 (82.9-95.3)</td>
<td>.1266</td>
</tr>
<tr>
<td>Expert 3 5-10</td>
<td>84.5 (78.4-91.1)</td>
<td>.8694</td>
<td>70.1 (59.8-78.7)</td>
<td>.0011*</td>
<td>98.9 (93.8-99.8)</td>
<td>.0005*</td>
</tr>
<tr>
<td>Expert 4 5-10</td>
<td>88.5 (82.9-92.4)</td>
<td>.3304</td>
<td>85.1 (76.1-91.1)</td>
<td>.6374</td>
<td>92.0 (84.3-96.0)</td>
<td>.0736</td>
</tr>
<tr>
<td>Expert 5 &gt;10</td>
<td>86.2 (80.3-90.6)</td>
<td>.7456</td>
<td>90.8 (82.9-95.3)</td>
<td>.4054</td>
<td>81.6 (72.2-88.4)</td>
<td>.0415</td>
</tr>
<tr>
<td>Expert 6 &gt;10</td>
<td>87.4 (81.6-91.5)</td>
<td>.7456</td>
<td>79.3 (69.6-86.5)</td>
<td>.1266</td>
<td>95.4 (88.8-98.2)</td>
<td>.0076*</td>
</tr>
<tr>
<td>Expert 7 &gt;10</td>
<td>82.8 (76.5-87.6)</td>
<td>.4652</td>
<td>83.9 (74.8-90.2)</td>
<td>.4054</td>
<td>81.6 (72.2-88.4)</td>
<td>.8084</td>
</tr>
<tr>
<td>Expert 8 &gt;10</td>
<td>71.3 (64.1-77.5)</td>
<td>.0013*</td>
<td>88.5 (80.1-93.6)</td>
<td>.7963</td>
<td>54.0 (43.6-64.1)</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Expert 9 &gt;10</td>
<td>92.0 (86.9-95.1)</td>
<td>.029</td>
<td>90.8 (82.9-95.3)</td>
<td>.4386</td>
<td>93.1 (85.8-96.8)</td>
<td>.029</td>
</tr>
<tr>
<td>Expert 10 5-10</td>
<td>78.2 (71.5-83.7)</td>
<td>.0897</td>
<td>67.8 (57.4-76.7)</td>
<td>.0016*</td>
<td>88.5 (80.1-93.6)</td>
<td>.2752</td>
</tr>
<tr>
<td>Expert 11 &gt;10</td>
<td>58.0 (50.6-65.5)</td>
<td>&lt;.0001*</td>
<td>54.0 (43.6-64.1)</td>
<td>&lt;.0001*</td>
<td>62.1 (51.6-71.5)</td>
<td>.0027*</td>
</tr>
</tbody>
</table>

The McNemar test was used to compare the accuracy, sensitivity, and specificity between the CAD system and the experts.

CAD: Computer-aided detection. CI: confidence interval.

The CAD system is significantly more accurate than the expert.

The CAD system is significantly less accurate than the expert.
The blue square represents the cancerous lesion, and the red square represents the noncancerous tissue.

Capsule Endoscopy (CE) and AI

- CE has been around since 2001
- Advances have included:
  - Suspected blood indicator (2003)
    - Sensitivity about 60% for active bleeding
  - Adaptive frame rate to improve resolution
  - Quick-view, attempts to select most relevant images
    - Top 10% out of 50,000 to 60,000 frames
    - Readers are not perfect with limited attention
AI Capsule Endoscopy

<table>
<thead>
<tr>
<th>Polyps</th>
<th>Nodules</th>
<th>Epithelial tumors</th>
<th>Submucosal tumors</th>
<th>Venous structures</th>
</tr>
</thead>
</table>

Saito H, et al. GIE. 2020

AI Impact on Reading Speed

- Training data
  - 158,235 SB-CE images from 1970 patients
- Validation data (retrospective)
  - 113,268,334 images from 5000 patients

The deep learning model based on CNN identified abnormalities with a sensitivity of 99.88% in per-patient and 99.90% in per lesion analysis

Ding et al. Gastroenterology 2019
**Aims**

- Artificial Intelligence (AI) promises to revolutionize Capsule Endoscopy (CE) by reducing reading time while maintaining high diagnostic accuracy. Primary aim was to compare the diagnostic accuracy of AI-assisted reading with Standard Reading (SR) when both are performed by expert readers (>500 cases) for detection of significant pathology of the small bowel. Secondary aim was to compare mean reading time of both reading modalities.

**Results**

- 19 out of 20 patients who underwent SBCE had a complete SB examination and were included in the interim per-patient analysis. SR and AI-assisted reading detected the same small bowel pathology in 15 patients and no pathology in the remaining 4 patients. Sensitivity, specificity, positive and negative predictive values of AI-based reading compared to SR were 100%. Mean SB reading time in SR and AI are reported in the following table.

---

*S. Piccioli*\(^1\), A. Bizzotto\(^2\), E.V. Pesatori\(^1\), D. Salvi\(^1\), E. Tettoni\(^1,2\), N. Belluardo\(^1,2\), C. Spada\(^1,2\)

\(^1\)Università Cattolica del Sacro Cuore, Rome, Italy, \(^2\)Fondazione Poliambulanza Istituto Ospedaliero, Internal Medicine, Gastroenterology and Digestive Endoscopy, Brescia, Italy
AI-Assisted Capsule Reading:

- Showed high diagnostic accuracy in detection small bowel pathology
- A significant reduction of reading time

<table>
<thead>
<tr>
<th></th>
<th>Standard Reading (SR)</th>
<th>AI-assisted Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean reading time ±SD</td>
<td>41.25 min ± 14.14</td>
<td>4.75 min ± 2.86</td>
</tr>
</tbody>
</table>

Lower GI Tract

- Colon cancer screening and surveillance
  - Challenge
    - Missed colon polyps
    - Optical diagnosis
    - Polyp size estimations
Image Classification Can Be challenging! The “dog or food?” challenge

Source: Teenybiscuit and Chuck Larson

- FDA approved AI technology:
  - Medtronic
  - GI Genius
  - Micro-Tech
  - Wision
AI in Colonoscopy

A Retrospective Analysis of 338 White Light Videos

Hassan et al GUT 2019.

99.7% sensitivity

82% faster polyp recognition than the endoscopist (RT)*

<1% false activation

Objective: To assess the detection accuracy and reaction time of a new AI system

Sensitivity: 337 true-positives and 1 false-negative per lesion

Speed: AI detected polyps before the average endoscopist in 277/337

Reaction time: 5 expert endoscopists each observed video clips pressing a button as soon as they detected the appearance of a polyp. AI’s earliest detection of each polyp was compared against the mean RT of the 5 reviewers for the same polyp

False positives: The average number of frames per video showing a false positive detection

Study conclusion: Achieved overall sensitivity per lesion of 99.7% (337 true positives and 1 false negative). The false positive rate was nearly negligible at less than 1%
Efficacy of Real-Time Computer-Aided Detection of Colorectal Neoplasia in a Randomized Trial

**Study Design:** This was a parallel, randomized, multicenter trial performed in 3 sites in Italy that participated in the organized population CRC screening program.

<table>
<thead>
<tr>
<th>Character</th>
<th>CADe-first (n = 113)</th>
<th>HDWL-first (n = 111)</th>
<th>P-value</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyp, total</td>
<td>32.70 (26/81)</td>
<td>33.71 (39/119)</td>
<td>.0007</td>
<td>1.0481</td>
<td>1.3573-2.9692</td>
</tr>
<tr>
<td>Adenoma, total</td>
<td>169</td>
<td>144</td>
<td>.2100</td>
<td>1.089</td>
<td>1.0780-2.0317</td>
</tr>
<tr>
<td>Hyperplastic polyp, total</td>
<td>66</td>
<td>41</td>
<td>.1969</td>
<td>0.7068</td>
<td>0.5111-1.1475</td>
</tr>
<tr>
<td>Sessile serrated lesions</td>
<td>11 (1/114)</td>
<td>19</td>
<td>.3455</td>
<td>1.3942</td>
<td>0.6990-2.7850</td>
</tr>
<tr>
<td>Advanced adenoma, total</td>
<td>11 (1/11)</td>
<td>0 (0/0)</td>
<td>.3146</td>
<td>-0.0001</td>
<td>&lt;0.0001-Inf</td>
</tr>
</tbody>
</table>

**Characteristics:**
- First-pass APC was higher in the CADe-first group 1.19 vs 0.90 HDWL
- First-pass ADR was 50.44% in the CADe-first group and 43.64% in the HDWL-first group (P = .3091)

**Morphology**
- Flat: 42% Increase
- Polypoid: 36% Increase

**Location**
- Proximal: 26% Increase
- Distal: 53% Increase

**Size**
- 6-9mm: 78% more likely to detect
- <5mm: 26% more likely to detect

**CADe did not increase the withdrawal time** and there were no differences in nonneoplastic resection rates between the groups suggesting it is equivalent to current best practice.
Meta-analysis of Prospective AI Trials

- 5 randomized trials were eligible for analysis.
- ADR with AI was 29.6 % versus 19.3 % without AI
- No difference in detection of advanced adenomas
- Mean APC was higher for small adenomas (≤ 5 mm) for AI versus non-Al (mean difference 0.15 [0.12 – 0.18])
- Not higher for larger adenomas
  - > 5 – ≤ 10 mm, mean difference 0.03 [0.01 – 0.05];
  - > 10 mm, mean difference 0.01 [0.00 – 0.02]
- Increased detection of small nonadvanced adenomas and polyps, but not of advanced adenomas

Impact of AI Based on Lesion Size

Beyond ADR – Value of AI

- AI never has endoscopist fatigue
- Makes you more efficient
- AI keeps an eye on the target
  - When getting tools for polypectomy
- If you lose site of the polyp AI assistance potentially can find it faster
- Reduce procedure quality variation amongst providers
Al Bowel Prep Analysis

- 93% accurate

Zhou J, Wu L, Wan X, et al
GASTROINTESTINAL ENDOSCOPY
Volume 91, No. 2 : 2020

Colon Cancer Depth of Invasion

- Test set: 7,734 images (657 lesions)
- Validation set: 1,631 images (156 lesions)
- Non-magnified WLE
- CNN – GoogLeNet

<table>
<thead>
<tr>
<th></th>
<th>Predicting non-invasive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>91% (89-93%)</td>
</tr>
<tr>
<td>Specificity</td>
<td>91% (89-93%)</td>
</tr>
<tr>
<td>AUROC</td>
<td>0.97 (0.96-0.98)</td>
</tr>
</tbody>
</table>

Xiaobei et al GIE 2021
Polyp Classification Tools

- Magnification endoscopy
- Chromoendoscopy
  - Dye based
  - Virtual
- Confocal laser endomicroscopy

Disadvantages
- Training
- Time
- Cost
- Further validation and adoption of these classification strategies may support a “resect and discard” or a “diagnose and leave” strategy
Colon Polyps

Differentiating Hyperplastic vs Adenoma

Nice Classification


ICV 0.98
AO 0.99
Cecum 1.0

AI identifies landmarks, marks times (Cecum)

Start Time: 09:23:04
Cecal Time: 09:26:38
IT: 00:03:34
Other Areas of AI Impact

- Inflammatory Bowel Disease
  - Challenge
    - Detecting Crohn’s disease on capsule endoscopy
    - Assessing disease activity of ulcerative colitis (UC)
  - Optical marker of remission
  - Detecting dysplasia in chronic UC patients
  - Identifying patients for clinical trials
**Ulcer Severity in CD**

- Retrospectively reviewed CE images of CD ulcers
- Experiment 1: 2 CE readers graded ulcer severity
- Experiment 2: A consensus reading by 3 CE readers was used to train an ordinal CNN

**Results:**
- 91% accurate for grade 1 ulcer vs grade 3 ulcer
- 78% accurate for grade 2 ulcer vs grade 3 ulcer
- 62% accurate for grade 1 ulcer vs grade 2 ulcer

Ulcers with the panenteric Pillcam Crohn’s Capsule: Overall accuracy 98.8%

Ferreira et al

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**AI and Endoscopic Ultrasound**

Deep-learning-based pancreas segmentation

Endoscope arriving at station 6

© ASGE/GIE
Jun Zhang,1,2,3 Liangru Zhu,4 Liwen Yao,1 Volume 92, No. 4 : 2020 GASTROINTESTINAL ENDOSCOPY

Station 1: Abdominal aorta
Station 2: Pancreatic body
Station 3: Pancreatic tail
Station 4: Confluence
Station 5: Pancreatic head from stomach
Station 6: Pancreatic head
AI Identifying Key EUS stations

AI Analyzing Medical Record Data To Risk Stratify Patients

Shung D. Digestive Diseases and Sciences (2019) 64:2078–208
AI In Hepatology

- Prognostic Disease Progression:
  - Banerjee et al developed an ANN with 22 clinical and biochemical inputs of 92 all-cause cirrhotic patients which was 91% accurate (95% CI 83–98%)

- Sclerosing Cholangitis Risk Estimate Tool (PREsTO)
  - 509 PSC patients
  - C-statistic of 0.96 for predicting liver-related event or liver-related mortality in 5 years

- Accurate diagnosis and characterization of liver lesions:
  - Yasaka et al developed a CNN model of 1,068 CT images from 460
  - AUROC of 0.84 using triphasic images validation cohort to delineate images into one of five categories:
    - Category A—classic HCC
    - Category B—malignant liver tumor other than HCC
    - Category C—Indeterminate masses
    - Category D—hemangiomas
    - Category E—cysts
  - AUROC of 0.92

- Assessment of Nonalcoholic Steatohepatitis
  - Several groups have utilized ML techniques to create an algorithm that grade the key histological features of NASH in a continuous fashion

Artificial intelligence in Hepatology Vaz et al. Seminars in Liver Disease Vol. 41 No. 4/2021

AI Pitfalls

- There is a dogma in the field of research—“garbage in, garbage out”—
- Understanding that the robustness and validity of the end product of a study are linked to the quality of the input data
- Accuracy of an AI model is dependent on high-quality dataset that is representative of the population the model is planned to be used on
- Ideally, large amounts of data are required to allow the system to learn and minimize errors
- In the past, this has been the Achilles’ heel to ubiquitous use of ML and DL models within the field of medicine
- However, with the advent of the electronic health record and computer systems with the capacity to store and process large amounts of data

Beam AL, Kohane IS. Big data and machine learning in health care. JAMA.2018;320(15):1517–1518
Next 5 years-AI in GI

Deep neural networks are making significant strides in:

- Speech
- Vision
- Language
- Search
- Robotics

Example Queries of the Future

- Is this a tubular adenoma or SSA and what is the size?
- Hey GIAI! Pull up endoscopic images of neuroendocrine tumors of the pancreas
- Transcribe my note and send instructions to patient in Spanish
Final Thoughts

• AI has the potential to improve an endoscopist’s performance for detection of pre-cancerous and cancerous lesion of the luminal GI tract

• Ultimately, as AI platforms mature there is an opportunity to not only improve quality metrics, but streamline the entire procedure experience

• AI will go beyond endoscopy and be a key element in patient care

Questions?

Seth A. Gross, MD, FACG

Nasim Parsa, MD
CONNECT AND COLLABORATE IN GI

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ACG Hepatology Circle
ACG GI Circle
ACG Functional GI Health and Nutrition Circle
ACG Women in GI Circle

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