How to trick artificial intelligence: rectal heterotopic gastric lateral spreading tumor

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CASE REPORT

We present the case of a 54-year-old man who came to our attention in January 2020 for a follow-up colonoscopy. He was treated in 2006 with a right hemicolectomy for an adenocarcinoma of the ascending colon. All consecutive follow-up colonoscopies had negative findings until 2016.

During the present endoscopic examination, we visualized in the rectum a plane homogeneous granular lesion (lateral spreading tumor granular type, Paris IIa), macroscopically covered by typical gastric mucosa, extending on the right luminal wall 10 cm proximal from the dentate line (Fig. 1). We performed the examination using a high-definition colonoscope (ELUXEO 700 series, Fujifilm, Tokyo, Japan) with deep learning systems for real-time computer-aided detection (CADe) and diagnosis (CADx) (CAD-EYE, Fujifilm). This CADe system works both with standard white-light and laser-color imaging. It indicates the area where the suspicious polyp is detected with a light-blue detection box and a sound signal (Fig. 2). The CADx system, on the other hand, only works while using blue-light imaging.

When a lesion is framed, the system displays a status bar that indicates the status of characterization analysis regarding the suspicious area, a visual assistance circle (green: hyperplastic; yellow: neoplastic), a position map that indicates the position of the suspicious area, and finally a characterization result (HYPERPLASTIC: hyperplastic polyps and sessile serrated lesion; NEOPLASTIC: adenoma and cancer) (Fig. 3). Our CADe system was tricked by the unrecognized lesion and sent random outputs on different sites within the lateral spreading tumor granular type but never included the entire lesion (Fig. 2). Using digital chromoendoscopy blue-

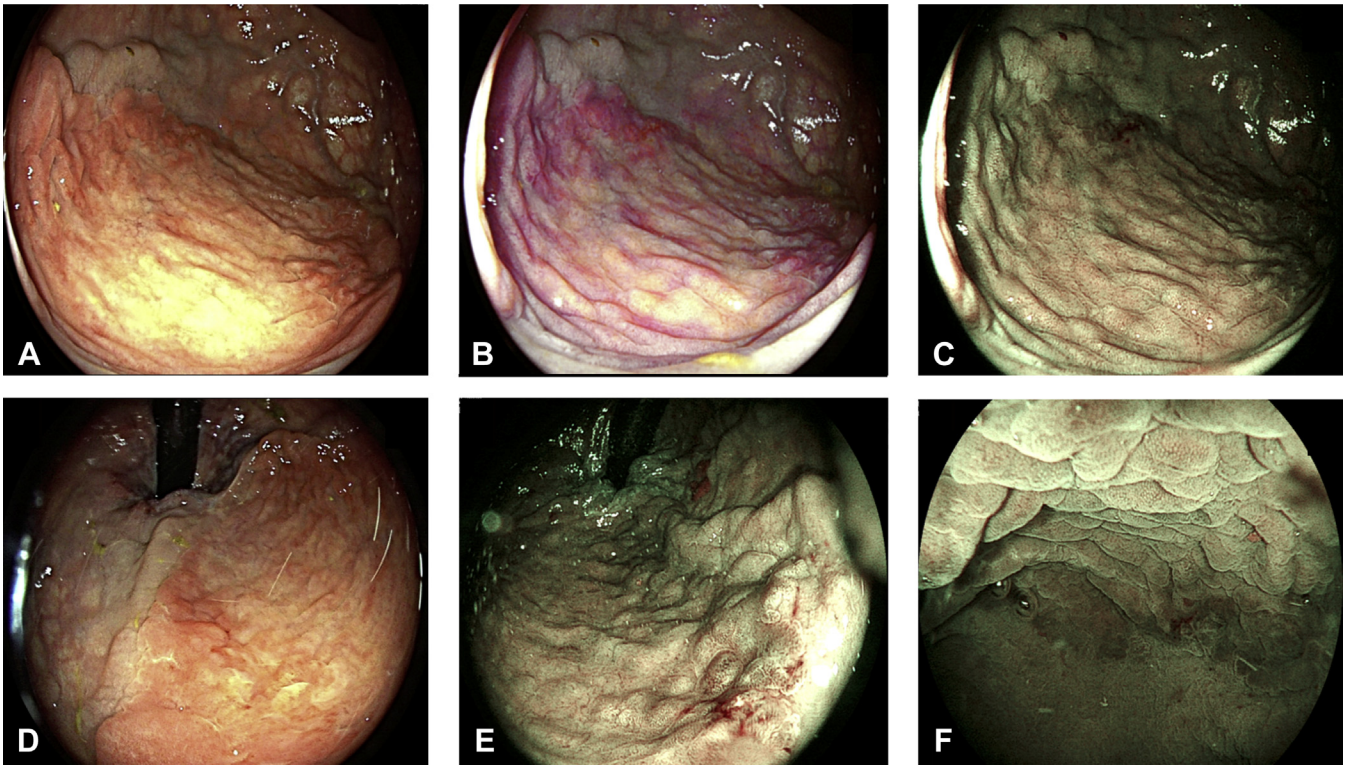

Figure 1. Homogeneous granular lateral spreading tumor (Paris IIa) macroscopically covered by typical gastric mucosa. Anteroversion: **A,** White-light. **B,** Laser-color imaging. **C,** Blue-light imaging. Retroversion: **D,** White-light. **E,** Blue-light imaging. **F,** Classic gastric mucosa appearance.

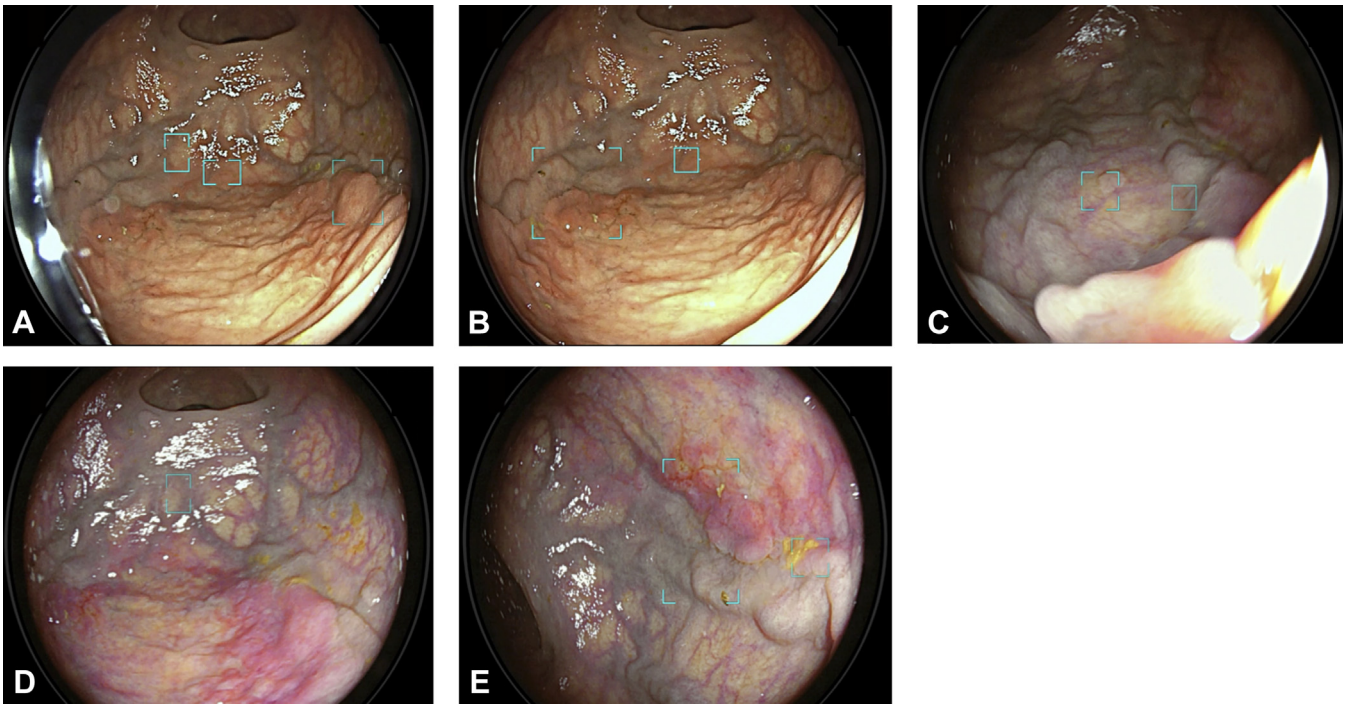

Figure 2. Random signaling of the computer-aided detection system. **A and B,** White-light. **C, D, and E,** Laser-color imaging.

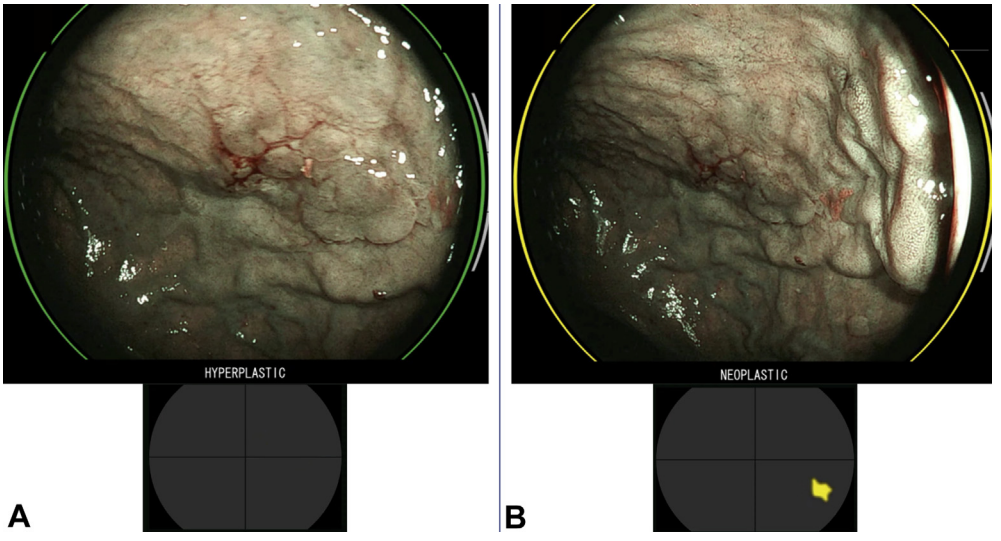

Figure 3. Computer-aided diagnosis system alternating hyperplastic **(A)** and neoplastic **(B)** signals on the same target.

light imaging/laser-color imaging, we identified no areas suspicious for dysplasia. However, the CADx system was also tricked by the tissue pattern, alternating neoplastic/hyperplastic signals (Fig. 3).

After marking the lesion margins circumferentially using a Hybrid Knife (Erbe Hybrid Knife, Erbe Elektromedizin, Tübingen, Germany) and injecting methylene blue and physiologic solution, we performed distal-to-proximal submucosal tunnelization of the lesion that was then used, thanks to the retroversion maneuver, as a traction aid for completion of the proximal–distal dissection of the lateral unresected margins to achieve complete en bloc dissection (Fig. 4). The resulting eschar appeared satisfactory, and we applied a prophylactic hemostatic agent (Purastat, Fujifilm). The resected specimen was then stretched and fixed mucosal side up onto a rigid support (Fig. 5). Final

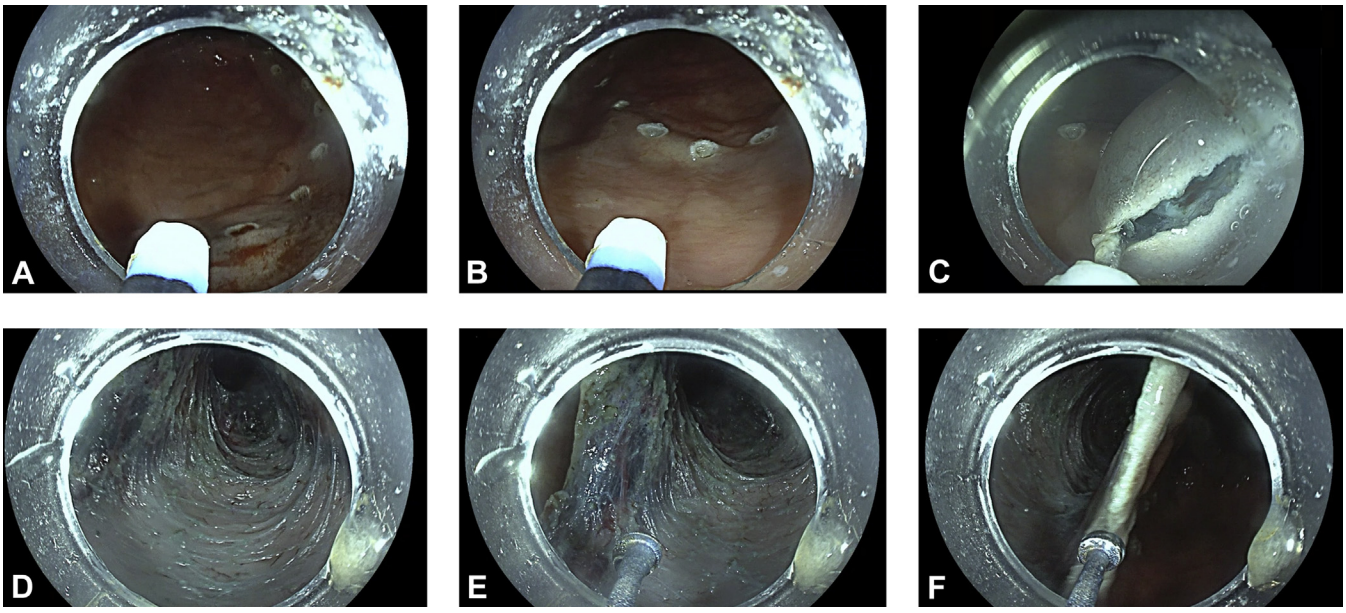

Figure 4. Endoscopic submucosal dissection. **A and B,** Marking the lesion. **C,** First incision of the injected lesion. **D,** Submucosal tunnel. **E and F,** Using reversion maneuver as a traction technique to achieve lateral margin dissection.

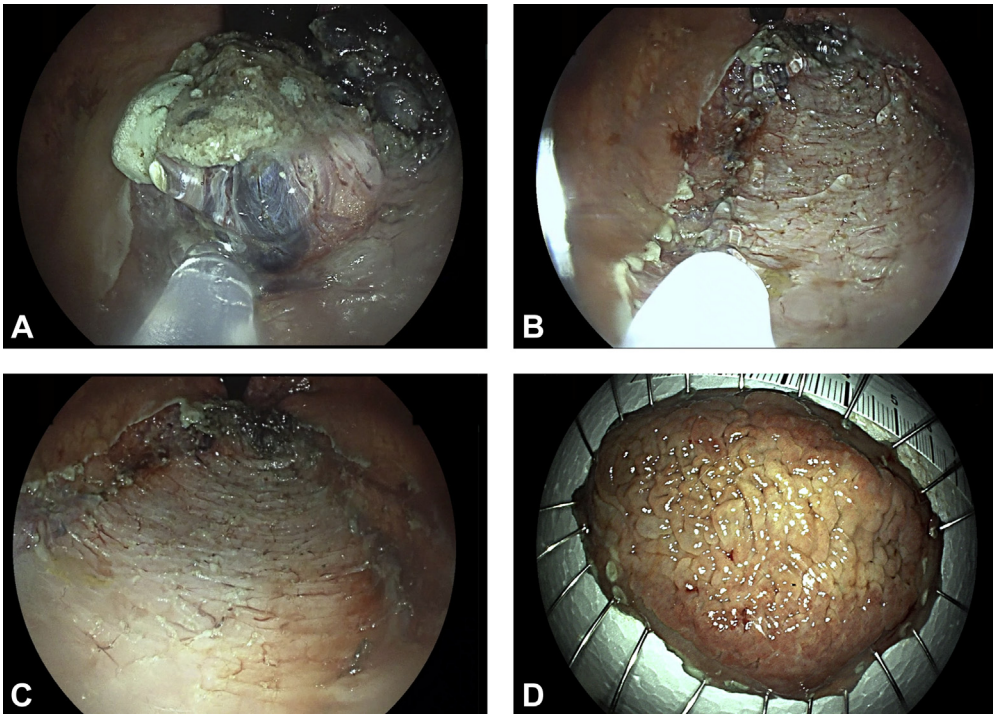

Figure 5. A and B, Prophylactic hemostatic agent application on eschar. **C,** Regular eschar. **D,** Resected specimen.

histology showed superficial gastric columnar epithelium with antral oxyntic glands, with edema and mild chronic inflammation (Video 1, available online at www.VideoGIE.org).

Heterotopic gastric mucosa (HGM) is represented by the presence of ectopic healthy gastric tissue.[1,2] HGM in the distal to the sigmoid colon is extremely rare; fewer than 100 cases have been reported (Table 1), among which only 1 case was treated with endoscopic submucosal dissection.[3]

Recently, artificial intelligence has been applied in the endoscopy field with promising results both as a manner

TABLE 1. Heterotopic gastric mucosa cases[3]

	Symptom categories		
	Asymptomatic (n = 14)	**Nonspecific (rectal) (n = 8)**	**Specific (rectal) (n=50)**
Males	10 (71%)	3 (38%)	32 (64%)
Age at diagnosis (y), median (range)	48 (26-69)	36 (5-65)	11 (0-58)
Age at diagnosis (y), n (%)			
≤10	0	1 (13%)	25 (50%)
11-18	0	0	8 (16%)
>18	14 (100%)	7 (88%)	17 (30%)
Localization: A + Perineal / L / M + Prox	4 / 2 / 5*	3 / 2 / 3	18 / 16 / 8*
Morphology: NP / P / U	8 / 6 / 0	6 / 1 / 1	23 / 19 / 9
Size (mm), median (range)	25 (7-60)	15 (5-40)	25 (1-50)
Histology: oxyntic / nonoxyntic	11 (85%) / 3	6 (100%) / 0*	42 (98%) / 1*
Histology: IM / dysplasia	3 (21%)	0	0
Adverse events	0	1 (13%)	22 (44%)

A + P, Anus and perineal rectum; *IM,* intestinal metaplasia; *L,* low rectum; *M + Prox,* middle and proximal rectum; *NP,* nonpolypoid; *P,* polypoid; *U,* ulcerated.
*Incomplete data.

of detection (CADe) and characterization (CADx).[4,5] These systems are trained through a process called deep learning, in which huge datasets of lesion examples are fed to the machine until the machine itself is able to extend the provided algorithms and even build new ones, thus becoming agnostic from the manual data input. Through this complex mechanism, artificial intelligence is able to perform image recognition on different lesions. As this case report shows, however, because these datasets only include common lesions (adenomas/sessile serrated lesion), rarer ones such as HGM cannot be detected or characterized because the machine was never taught how to detect these lesions. Although they may have a vast range of uses, CADe and CADx systems have to be used rationally as a tool; human experience and decision-making processes cannot be transcribed as an algorithm.

DISCLOSURE

All authors disclosed no financial relationships.

Abbreviations: CADe, computer-aided detection; CADx, computer-aided diagnosis; HGM, heterotopic gastric mucosa.

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