no relationship with LC or AEs has been found. In achalasia, for example, there is an abnormal relaxation of the lower esophageal sphincter combined with esophageal aperistalsis. Of both, POEM throughout the myotomy of the lower esophageal sphincter can generate the expected CS. However, the lack of experience in the performance of third-space procedures in the early years of POEM could potentially have affected the outcomes of this procedure in the first patients treated with this technique. This has been confirmed by several authors throughout the role of LC in early and midterm outcomes.[14-16] This could be explained by the lack of the endoscopist's experience with third-space procedures, translated in the potential absence of an adequate rupture of the lower esophageal sphincter myotomy, besides which the endoscopist thought that this was adequately performed, mostly in difficult cases such as those with submucosal fibrosis. AEs have similar behavior. However, in RG, this is completely different, first, because most of the endoscopists who perform these procedures have previous good experience in POEM (as in our case); therefore, the third space is a well-known territory, meaning that the operator can correctly identify different structures including the pyloric muscle ring, and therefore its myotomy can be performed adequately, minimizing or avoiding AEs during the procedure; and second, because the pathophysiology of RG is very complex. Besides that, the rationale of CS is based on the indirect improvement in gastric emptying throughout an adequate PRM, whereas no homogeneous response is observed among different causes of subtypes of RG. In our case, we obtained the best results in patients with diabetes with nausea and vomiting, early diagnosis, and good improvement in early-term measures (GCSI and RP4H), probably explained by the major proportion of patients with pylorospasm in this population; however, this has not been observed in all causes of RG. In conclusion, although there is no universal criterion standard of treatment for this disease, G-POEM represents a potential first-line therapy in some patients, such as those with diabetes; however, efforts for clarification of the real role of G-POEM in RG must be continued.

DISCLOSURE

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Artificial intelligence–assisted cholangioscopy for automatic detection of malignant biliary strictures

To the Editor:

We read with great interest the article by Mascarenhas Saraiva et al[1] regarding optimal diagnosis of malignant biliary strictures by using an artificial intelligence (AI) algorithm. We concur with their findings and agree that the introduction of AI algorithms such as convolutional neural network (CNN) imaging may significantly increase our

diagnostic repertoire in dealing with patients who have suspected bile duct cancers. In addition, owing to the high accuracy of AI-assisted cholangioscopy, patients with highly suggestive lesions on cholangioscopy who are suitable for surgery may be able to proceed to early surgery before cancer progresses.

One of the major potential benefits of AI-assisted cholangioscopy is that a diagnosis may be made without further invasive testing such as biopsy and hence is likely to result in fewer procedure-associated adverse events.[2] Although the potential of AI-assisted cholangioscopy is promising, it is critical to delineate some challenges. CNN algorithms require large datasets for validation, which are not readily available. As with any computer vision machine learning modality, addressing "overfitting" and bias are also important.[3] It is key that we focus not only on algorithm performance but also on increasing the trustworthiness of the algorithms; and these AI-imaging applications should be able to help save diagnosis time.

We predict a trajectory of increased use and adoption of AI-assisted cholangioscopy. AI-assisted cholangioscopy is likely to meet the test of pervasiveness, improvement, and innovation. The adoption of AI-assisted cholangioscopy will likely follow Amara's law and the 5 stages of the hype cycle. We believe that we are still in the infant stages of this technology, and this phase may last 3 to 5 years before there is a peak of inflated expectation. The trough of disillusionment and slopes of enlightenment may only be observed in the next decades.

DISCLOSURE

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Response:

We are honored by the interest of Njei et al[1] in our proof-of-concept work.[2] We share their view of a potential role of artificial intelligence (AI) for significantly enhancing the diagnostic yield of digital cholangioscopy for malignant biliary strictures. In our view, the application of AI to cholangioscopy will, at this stage, work alongside current criterion standard techniques, as a complement rather than disrupting the current standard of care. Therefore, although we agree with Njei et al[1] that AI-assisted cholangioscopy should ultimately achieve diagnosis without more invasive techniques, we believe that in the near future AI will be applied to increase the yield of current techniques, particularly cholangioscopy-guided biopsies, which remain the current criterion standard. This could be potentially accomplished through accurate detection of morphologic features intricately associated with malignant strictures, as is the case with tumor vessels.[3,4]

The potential of convolutional neural networks for the analysis of endoscopic images is vast. Notwithstanding, we subscribe that these promising results should be analyzed with consideration of current methodologic limitations and knowledge gaps. We believe that the path toward clinically applicable AI-assisted cholangioscopy has only just begun. In fact, the readiness level of AI technologies for cholangioscopy remains at early stages (Fig. 1), because most studies assess their performance in controlled settings.[2,5]

Trusting the clinical output of an AI algorithm will require moving from opaque black-box AI models toward explainable AI algorithms, in which users (preferably both healthcare practitioners and patients) understand AI recommendations. Attempts to improve explainability, for example through the application of heat maps, are ongoing.[6,7] The development of this technology will require several years, probably decades, and we should not expect a linear path. A nadir after this initial zenith of enthusiasm is predictable, but we expect that work on this field will ultimately lead to a heightened plateau of productivity.