GROUP TALK
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DEVELOPMENT OF A REAL-TIME ARTIFICIAL INTELLIGENCE SYSTEM TO IMPROVE DIAGNOSTIC ACCURACY AND FACILITATE INDIVIDUALIZED CARE FOR PATIENTS WITH CHOLANGIOCARCINOMA

Pictured left to right: Dr. Dheera Reddy, Dr. Navine Nasser-Ghodsi and Dr. Neil Marya.

Cholangiocarcinoma (CCA) is a malignancy of the bile ducts associated with significant morbidity and mortality. Current diagnostic tools have low sensitivity and accuracy, which delays diagnosis and partly explains why a minority of patients are offered curative resection. Multicenter data over several decades has demonstrated that carefully selected patients with unresectable perihilar cholangiocarcinoma who undergo neoadjuvant chemoradiation ahead of liver transplantation have a significant survival benefit. However, patients are at risk of tumor progression while awaiting transplant and are at risk of cancer recurrence even after transplant.

But there is hope on the horizon. Novel artificial intelligence (AI) technology, developed by the multidisciplinary team of Neil B. Marya, MD, Assistant Clinical Professor, Division of Gastroenterology, Department of Medicine; Navine Nasser-Ghodsi, MD, Assistant Professor, Division of Gastroenterology, Department of Medicine; and Dheera A. Reddy, MD, Assistant Professor, Division of Transplant Surgery, Department of Surgery; analyzes and interprets cholangioscopy (a procedure that allows for direct visualization of the biliary tree) videos to improve the diagnostic accuracy of classifying biliary strictures as benign or malignant. The group aims to optimize the performance of this AI system to address the need for early and accurate classification of biliary strictures, and better understand which patients are at risk of tumor progression or cancer recurrence in the context of liver transplantation.

“The goal of our project is to develop an artificial intelligence that will provide an early and accurate diagnosis of bile duct cancer,” noted Dr. Marya. “We hope that this technology facilitates more patients with bile duct cancer being offered curative therapy.”

Provided the poor performance of current diagnostic sampling modalities (i.e., brush cytology and forceps biopsy) the group has leveraged AI technology to improve the diagnosis of CCA. Through their development an AI, the team is now able to use a computer system to analyze cholangioscopy videos and autonomously provide a diagnosis. When analyzing a reserved dataset of recorded cholangioscopy videos uninvolved in model training, the AI was significantly more accurate (0.906) than either brush cytology (0.625; $p = 0.04$) or forceps biopsy (0.609; $p = 0.03$). Since this initial study, the group has developed a novel medical device that deploys the AI and performs real-time, on-premise model predictions that are integrated with the clinical workflow during endoscopy. The device directs endoscopists to areas of AI-determined concern within the biliary tree that should be sampled in real time (i.e., computer-aided detection [CADe]) while also providing an overall interpretation of the video footage as representing cancer or benign disease (i.e., computer-aided diagnosis [CADx]).

To advance this work, the group will now leverage their Prize for Academic Collaboration and Excellence (PACE) funding to focus on retraining the AI system to improve overall diagnostic accuracy, perform a prospective clinical trial evaluating the clinical performance of the real-time AI system, and identify disease progression, disease stability, or treatment response in patients with known CCA to facilitate personalized care based on individualized risk of CCA disease progression.

Thankful for the opportunity to participate in the PACE program, offered by UMass Memorial Medical Group and UMass Chan Medical School, Dr. Nasser-Ghodsi shared, “The PACE program encourages caregivers across different departments to collaborate and provide specialized care for patients in the region and beyond.”