Usefulness of artificial intelligence–assisted digital single-operator cholangioscopy as a second-opinion consultation tool during interhospital assessment of an indeterminate biliary stricture: a case report

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CASE PRESENTATION

A 57-year-old man with idiopathic portal thrombosis managed with a transjugular intrahepatic portosystemic shunt presented to our institution with jaundice. Tumor markers were negative, but MRCP showed proximal common bile duct stenosis (Fig. 1). The patient underwent EUS, which identified a 14.03- × 10.97- × 20.00-mm homogeneous hypoechoic localized lesion in the common bile duct at the emergence of the cystic duct (Fig. 2). EUS-guided fine-needle biopsy (EUS-FNB) was performed with a 22-gauge needle, revealing normal tissue (Fig. 3). The patient underwent ERCP with brush cytology of the lesion, but the results revealed a benign lesion. Afterward, a plastic stent was inserted and the patient was discharged (Fig. 4).

Three days later, because of inconclusive histological and immunohistochemical diagnosis, the patient underwent a digital single-operator cholangioscopy (DSOC) (Spyglass DS System; Boston Scientific, Marlborough, Mass, USA). Using the Carlos Robles-Medranda (CRM) classification through direct visualization of the lesion,[1] the operators (J.R.C., J.C.G.) interpreted the lesion as a nonneoplastic inflammatory lesion. Biopsy of the lesion was inconclusive. Skeptical about the interpretation, the team (J.R.C., J.C.G.) sent the recorded video for a second opinion to the Instituto Ecuatoriano de Enfermedades Digestivas: first, for an evaluation by a DSOC expert (C.R.-M., who interpreted the lesion as a type I/IV neoplastic lesion), and then to be assessed with a novel artificial intelligence (AI) cholangioscopic system. AIWorks-Cholangioscopy (mdconsgroup, Guayaquil, Ecuador) is a cholangioscopy-based AI software trained to detect neoplastic lesions in the bile duct, based on the presence of dilated and tortuous vessels, irregular mucosal surfaces, polypoid lesions, irregular nodulations, raised intraductal lesions, ulcerations, and a honeycomb pattern. These are common features of neoplasia in the CRM and Mendoza classifications.[1] It is used with

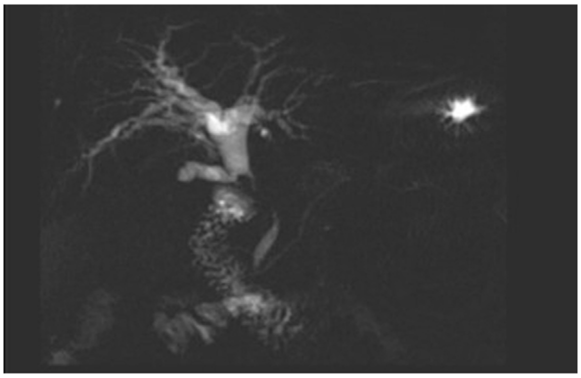

Figure 1. Proximal common bile duct stenosis observed during MRCP in a 57-year-old man.

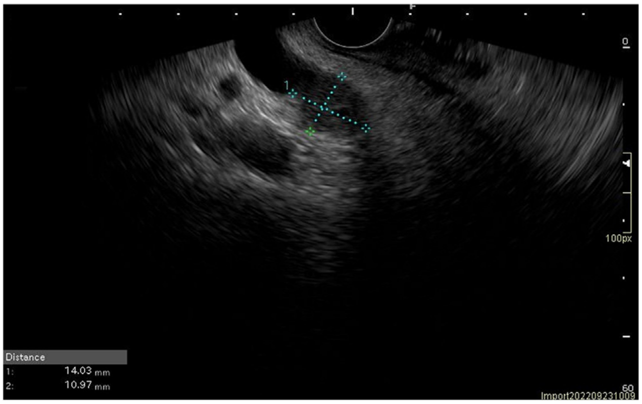

Figure 2. Hypoechoic lesion observed in the common bile duct on EUS.

Abbreviations: AI, artificial intelligence; CRM, Carlos Robles-Medranda; DSOC, digital single-operator cholangioscopy; EUS-FNB, EUS fine-needle biopsy.

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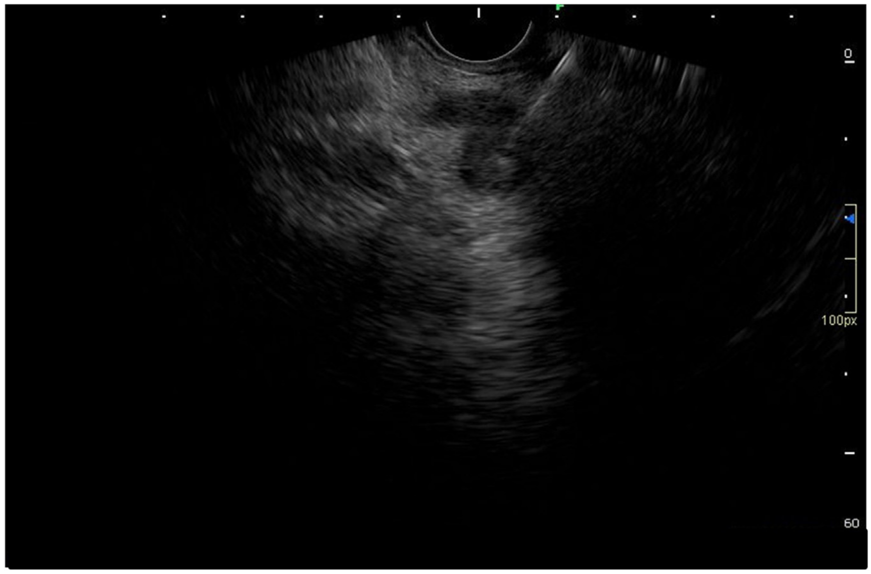

Figure 3. EUS-guided fine-needle biopsy of the lesion.

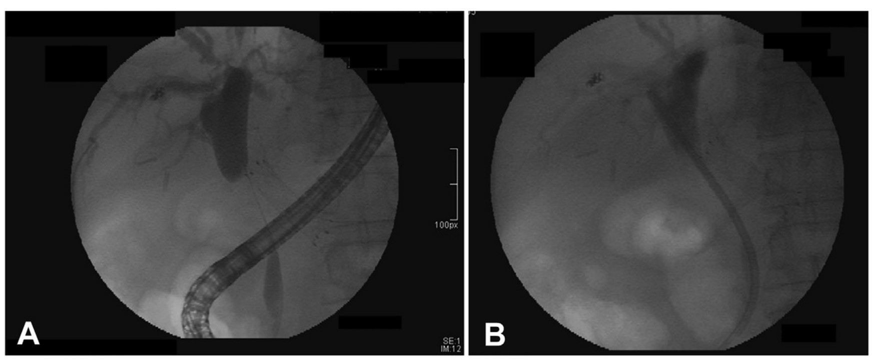

Figure 4. Fluoroscopic image of a 57-year-old man. **A,** Proximal common bile duct stenosis. **B,** Plastic stent inserted into the common bile duct.

prerecorded videos and live cholangioscopic procedures. This system detected areas of neoplasia and highlighted the area of interest within a bounding box (Fig. 5; Video 1, available online at www.videogie.org). Histological results from the targeted biopsies in a second cholangioscopy identified the lesion as adenocarcinoma (Fig. 6).

Figure 5. Area suggestive of neoplasia highlighted by a bounding box detected with a novel cholangioscopy-based convolutional neural network (AIWorks-Cholangioscopy; mdconsgroup, Guayaquil, Ecuador).

DISCUSSION

Bile duct strictures can be caused by neoplastic and nonneoplastic lesions, affecting diagnostic procedures and early treatment. ERCP with brush cytology is the most commonly used procedure to evaluate the biliary system, but its low accuracy and imaging limitations may lead to diagnostic, sampling, and therapeutic errors.[2] DSOC provides endoscopists with a direct visualization of the biliary system, overcoming ERCP's limitations.[3] Even though several classifications based on observed macroscopic features within the biliary strictures with DSOC

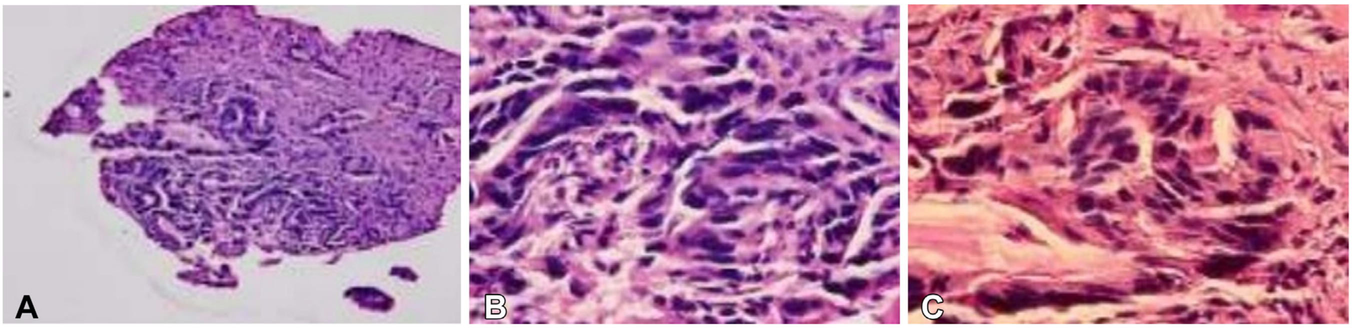

Figure 6. Histopathology of the biopsy sample obtained from the area suggestive of neoplasia detected with the AIWorks-Cholangioscopy software (mdconsgroup, Guayaquil, Ecuador). **A,** H&E, orig. mag. ×4; **B** and **C,** H&E, orig. mag. ×200.

have been proposed, a discrepancy between observers' visual impressions still exists.[1,4,5] In this case, ERCP with brush cytology, EUS-FNB, and operators' visual impression was inconclusive. EUS-FNB could be affected by the distance and adjacent structures that could interfere with the biopsy[6]; however, this system's high accuracy provided a second opinion to expert endoscopists' DSOC interpretation,[7] redirecting patient management. The advantage of this system over previous DSOC models resides in its ability to be applied to previously recorded videos and live DSOC procedures without delay.[7,8] Additionally, this system can be used with the different DSOC probes available on the market.[7] An AI model that can accurately detect neoplastic lesions can be purposed to train less-experienced endoscopists to identify areas suggestive of neoplasia and shorten the learning curve for such identification. Furthermore, AI models could assist expert and nonexpert endoscopists while reducing interobserver agreement mismatch and provide improved image interpretation. In conclusion, the AIWorks-Cholangioscopy system could offer consultation on lesions suggestive of neoplasia, aiding experts and less-experienced endoscopists in obtaining better histopathological samples and cutting the interobserver disagreement among experts.

DISCLOSURE

Dr Robles-Medranda is a consultant and key opinion leader for Pentax Medical, Steris, Micro-tech, G-Tech Medical Supply, CREO Medical, and EndoSound and is a key opinion leader and speaker for mdconsgroup. All other authors disclosed no financial relationships.

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