An estimated 39,000 cases of cholangiocarcinoma (CC) were diagnosed in the United States in 2016.1 Of the patients with diagnoses of CC, two-thirds are unable to undergo surgical resection and require locoregional therapy.2,3 Given the ever-rising prevalence of this condition and the intimate involvement of the advanced endoscopist in the care of these patients, intraductal therapies have arisen, which may serve an important role in the care of CC.

One such technology is an intraductal radiofrequency ablation (RFA) device, which uses an 8F, 180-cm wire-guided catheter with 2 stainless steel electrodes covering 25 mm of the treatment site (Fig. 1). This technology allows for the delivery of RF energy within the biliary tree for the treatment of CC.

An 81-year-old man with unresectable CC (due to multilobar disease), who had undergone 1 cycle of chemotherapy, presented for ERCP with stent exchange. His medical history included chronic obstructive pulmonary disease and coronary artery disease. His initial liver function values were minimally elevated, with an aspartate aminotransferase of 56 U/L, alanine aminotransferase of 62 U/L, total bilirubin of 2.1 mg/dL, and alkaline phosphatase of 286 U/L.

The patient received a diagnosis of a 4.4 × 5.9 cm hyperintense mass with central enhancement, and a pronounced peripheral rim in the caudate lobe and mass in the left hepatic duct (Fig. 2).

An ERCP demonstrated a prominent biliary tumor in the left main hepatic duct. Biopsy of the tumor was performed with intraductal forceps (Fig. 3). Additionally, during this procedure the patient underwent placement of a plastic biliary stent during the wait for the diagnosis (Fig. 4). Examination of these biopsy specimens later confirmed the diagnosis of CC.

The patient was seen by medical and surgical oncologists during a multidisciplinary tumor board, and the plan was to give chemotherapy with concomitant locoregional therapy, using intraductal RFA to allow for maximal palliative effect and prolong the interval for stent exchange.

During chemotherapy, the patient returned for ERCP, for which a 10F × 15 cm plastic stent was placed.

After the completion of 1 cycle of chemotherapy, CT was then performed for staging purpose and revealed an interval increased enhancement of the left biliary ductal segment and a 2.7 × 2.6 caudate lobe liver lesion (Fig. 5). This interval decrease in tumor size was likely due to the systemic effects of his chemotherapy.

The patient returned for ERCP with locoregional RFA after his imaging results were obtained (Video 1, available online at www.VideoGIE.org). After stent removal, wire-guided cannulation was performed with a standard bowing sphinctertome and a 0.035 × 260 cm wire. A cholangiogram then demonstrated persistent stenosis of the left hepatic duct. The duct was swept in an attempt to clear

Figure 1. To-scale view of intraductal radiofrequency ablation device showing an 8F, 180-cm, wire-guided catheter with 2 stainless steel electrodes covering 25 mm of intraductal space.
**Figure 2.** 

A, MRI view before RFA showing 4.4 x 4.2 x 5.9 cm hyperintense mass with central enhancement and pronounced peripheral rim in the caudate lobe and mass in left hepatic duct.  

B, Cholangiographic view before RFA showing left hepatic ductal stenosis.  

*RFA,* radiofrequency ablation.

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**Figure 3.** Cholangioscopic views before radiofrequency ablation showing  

A, a prominent biliary tumor in the left main hepatic duct, and  

B, biopsy of tumor with intraductal forceps.

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**Figure 4.** Cholangiographic views during chemotherapy showing  

A, persistent left hepatic ductal stenosis and  

B, plastic stent replaced into left hepatic ductal system.
debris, which may have been causing the residual stenosis. However, several sweeps demonstrated no visible debris.

After the balloon sweep, a cholangioscope was inserted into the biliary system, revealing papillary irregularities and localized intraductal narrowing in the left main hepatic duct.

The cholangioscope was then withdrawn, and the intraductal RFA (IDRFA) probe was inserted through the biliary orifice up into the left main hepatic duct above the area of stenosis. Using a bipolar setting effect 8 at 7 watts, we performed ablation for a total of 90 seconds. This ablation setting is recommended for left and right ductal therapy as opposed to effect 8 at 10 watts for common ductal therapy (Fig. 6). After the probe was held for 60 seconds after the first treatment, the probe was then moved distally toward the main hepatic duct, allowing for overlap of the initial site of locoregional therapy, and a second treatment of RFA was applied (Fig. 7).

**Figure 5.** CT view before radiofrequency ablation showing 2.7 x 2.6 caudate lobe liver lesion.

**Figure 6.** Electrosurgical generator settings for RFA. **A,** For intraductal RFA, effect 8 at 7 watts. **B,** For common ductal RFA, effect 8 at 10 watts. *RFA,* radiofrequency ablation.

**Figure 7.** Cholangiographic views with RFA probe. **A,** Proximal-most treatment location with RFA. **B,** Distal-most treatment location with RFA. *RFA,* radiofrequency ablation.
The bile duct was then re-explored with the cholangioscope and advanced to the left main hepatic duct, demonstrating interlacing white tissue and absence of papillary changes at the site of treatment. Additionally, there was no evidence of hemorrhage or perforation. The cholangioscope was again removed, and the duct again swept, now revealing an evident tissue cast after RFA.

Finally, a new 10F × 12 cm double-flapped plastic biliary stent was placed, crossing the left hepatic duct.

Six months later, after the patient completed a second cycle of chemotherapy, CT, in comparison with the patient’s prior imaging, demonstrated an interval decrease in the size of the caudate lobe lesion to approximately 1.7 × 2.1 cm (previously 2.6 × 2.7 cm), with post-RFA changes around the left hepatic duct and an intact stent with pneumobilia (Fig. 8). This decrease in tumor size was likely due to systemic chemotherapy.

Repeated ERCP was 6 months after the RFA was performed, during which the cholangiogram showed improvement in the left hepatic ductal stenosis (Fig. 9). A cholangioscope was used, the left duct remained patent, and poststenting inflammatory changes were visible. His liver function values remained normal, and he has had no hospitalizations or obstructive biliary adverse events.

Preclinical data in animal models have confirmed the safety and efficacy of RFA in this setting. An additional open-labeled study in humans demonstrated clinical safety, leading to subsequent device approval. Since the availability of this probe, retrospective series have evaluated its efficacy in biliary neoplasms not amenable to surgery. These retrospective data have alluded to the benefit of RFA in improving stenosis, the duration of stent patency, and survival.

In this case, the appearance of postintraductal RFA was an interesting finding as seen by a cobweb appearance on cholangioscopy.

DISCLOSURE

Dr Khara is a consultant for Medtronic-Covidien. Dr Jobal is a consultant for Boston Scientific. Dr Diebl is a consultant for Boston Scientific and Olympus. All other authors disclosed no financial relationships relevant to this publication.
Abbreviations: CC, cholangiocarcinoma; RFA, radiofrequency ablation.

REFERENCES

1. https://seer.cancer.gov/statfacts/html/livibd.html. Accessed May 23, 2017.
2. Benson AB, D'Angelica ML, Abrams T, et al. NCCN Guidelines in oncology: Hepatobiliary Cancers, Version 2. 2016. https://nccn.org/professionals/physician_gls/pdf/hepatobiliary.pdf. Accessed May 23, 2017.
3. Nakeeb A, Pitt HA, Sohn TA, et al. Cholangiocarcinoma: a spectrum of intrahepatic, perihilar, and distal tumors. Ann Surg 1996;224:463-73, discussion 473-5.
4. Tal AO, Vermehren J, Reiedrich-Rust M, et al. Intraductal endoscopic radiofrequency ablation for the treatment of hilar non-resectable malignant bile duct obstruction. World J Gastrointest Endosc 2014;6:13-9.
5. Itoi T, Isayama H, Sofuni A, et al. Evaluation of the effects of a novel endoscopically applied ex-vivo pig liver. J Hepatobiliary Pancreat Sci 2012;19:543-7.
6. Monga A, Gupta R, Ramchandani M, et al. Endoscopic radiofrequency ablation of cholangiocarcinoma: a new palliative treatment modality. Gastrointest Endosc 2011;73:149-53.
7. Steel AW, Postgate AJ, Khorsandi SE, et al. Endoscopically applied radiofrequency ablation appears to be safe in the treatment of malignant biliary obstruction. Gastrointest Endosc 2011;73:149-53.
8. Kallis Y, Phillips N, Steel A, et al. Analysis of endoscopic radiofrequency ablation of biliary malignant strictures in pancreatic cancer suggests potential survival benefit. Dig Dis Sci 2015;60:3449-55.
9. Sharaiha RZ, Sethi A, Weaver KR, et al. Impact of radiofrequency ablation on malignant biliary strictures: results of a collaborative registry. Dig Dis Sci 2015;60:2164-9.
10. Strand DS, Cosgrove ND, Patrie JT, et al. ERCP-directed radiofrequency ablation and photodynamic therapy are associated with comparable survival in the treatment of unresectable cholangiocarcinoma. Gastrointestin Endosc 2014;80:794-804.
11. Dola W, Shreiber F, Schwaighofer H, et al. Endoscopic radiofrequency ablation for malignant biliary obstruction: a nationwide retrospective study of 84 consecutive applications. Surgical Endosc 2014;28:854-60.