Initial experience of EUS-guided radiofrequency ablation of unresectable pancreatic cancer

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Background and Aims: Radiofrequency ablation (RFA) has been used as a valuable treatment modality for various unresectable malignancies. EUS-guided radiofrequency ablation (EUS-RFA) of the porcine pancreas was reported to be feasible and safe in our previous study, suggesting that EUS-RFA may be applicable as an adjunct and effective alternative treatment method for unresectable pancreatic cancer. This study aimed to assess the technical feasibility and safety of EUS-RFA for unresectable pancreatic cancer.

Methods: An 18-gauge endoscopic RFA electrode and a radiofrequency generator were used for the procedure. The length of the exposed tip of the RFA electrode was 10 mm. After insertion of the RFA electrode into the mass, the radiofrequency generator was activated to deliver 20 to 50 W ablation power for 10 seconds. Depending on tumor size, the procedure was repeated to sufficiently cover the tumor.

Results: EUS-RFA was performed successfully in all 6 patients (median age 62 years, range 43-73 years). Pancreatic cancer was located in the head (n = 4) or body (n = 2) of the pancreas. The median diameter of masses was 3.8 cm (range 3cm-9cm). Four patients had stage 3 disease, and 2 patients had stage 4 disease. After the procedure, 2 patients experienced mild abdominal pain, but there were no other adverse events such as pancreatitis or bleeding.

Conclusions: EUS-RFA could be a technically feasible and safe option for patients with unresectable pancreatic cancer.

Pancreatic cancer carries a poor prognosis, with a 5-year overall survival rate of <5% and a median survival of <6 months.[1] Resection provides the only chance of a cure, with 5-year overall survival rates of 18% to 24%; unfortunately, however, only one fifth of patients present with resectable disease. The outcomes of chemotherapy or chemoradiation therapy are not satisfactory,[2] with most pancreatic cancer patients experiencing only a small benefit. Therefore, new advances for the treatment of pancreatic cancer are needed.

Radiofrequency ablation (RFA) works by emitting energy resulting in coagulative necrosis of the surrounding tissue.[2,3] RFA is considered a safe and potentially curative method and has been used widely for the treatment of tumors of the liver, lung, and kidney, but not of the pancreas. The reluctance of clinicians to use RFA for pancreatic cancer may be related to the fear of adverse events, such as thermal injury-induced pancreatitis, thermal damage to structures around the pancreas, and technical limitations.[4] Recent studies have shown that RFA is feasible in patients with unresectable pancreatic cancer in an open, laparoscopic, or percutaneous setting.[5] Particularly, EUS-guided RFA (EUS-RFA) allows real-time imaging of the pancreatic mass, where RFA may result in safe tissue ablation.

Abbreviations: EUS-RFA, EUS-guided radiofrequency ablation; RFA, radiofrequency ablation.

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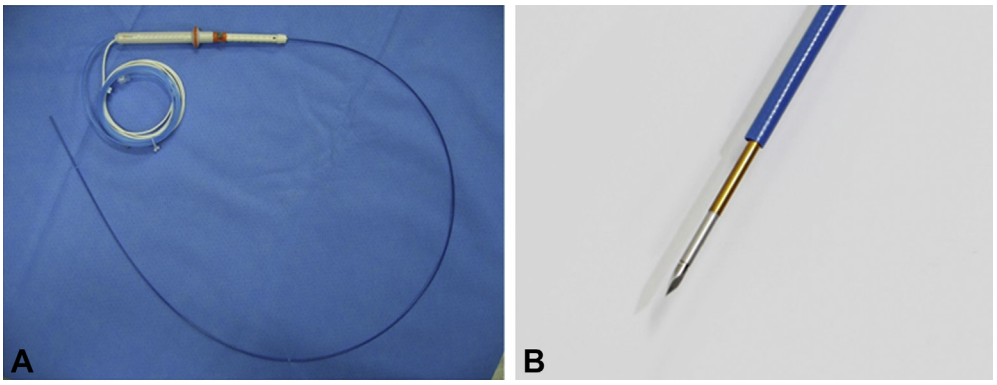

Figure 1. A, A radiofrequency ablation (RFA) electrode. An 18-gauge RFA electrode is composed of an electrode covered with protective tubing, a handle, and catheters for the cooling system. **B,** The exposed distal end of the electrode was needle-shaped and echogenic, and the length of the exposed tip of the electrode was 10 mm.

TABLE 1. Characteristics of patients

No.	Age	Sex	Tumor size, cm	Tumor location	Primary symptom	Session of RFA	Duration of follow-up, mo	Adjuvant chemotherapy	Procedure-related adverse events
1	73	Female	3.8	Head	Abdominal pain	1	3	None	None
2	43	Female	5.6	Head	Abdominal pain	2	4	Gemcitabine	Abdominal pain
3	68	Male	3.7	Head	Weight loss	1	6	Gemcitabine	None
4	59	Female	9	Body	Abdominal pain	2	2	Gemcitabine	Abdominal pain
5	50	Female	3	Head	Jaundice	1	6	None	None
6	67	Female	3.6	Body	Abdominal pain	1	4	None	None

RFA, Radiofrequency ablation.

According to our previous study, EUS-RFA was feasible and safe for the porcine pancreas.[6]

The aim of this study was to assess the feasibility and safety of EUS-RFA for unresectable pancreatic cancer.

PATIENTS AND METHODS

We obtained permission from the Institutional Review Board of each center and performed prospective data collection. A total of 6 consecutive patients were included in the study between February 2013 and March 2014. The inclusion criteria were (1) histologically confirmed pancreatic cancer, (2) unresectable stage due to locally advanced or metastasis disease, and (3) resistance to a previous treatment modality. The exclusion criteria were (1) advanced heart or lung disease precluding adequate sedation, (2) poor performance status, and (3) a lack of informed consent.

The procedure was performed by 2 experienced endosonographers (D.W.S. and S.L.), experienced in both ERCP and EUS and who perform >500 EUS procedures for pancreaticobiliary diseases annually.

EUS-RFA was performed by using an 18-gauge RFA needle and a VIVA RF generator (STARmed, Koyang, Korea). The total length of the electrode, including the delivery system, was 150 cm. The exposed distal end of the electrode was needle-shaped and echogenic. The length of the exposed tip of the RFA electrode was 10 mm (Fig. 1). During ablation, the radiofrequency electrode was cooled and perfused internally with circulating chilled saline solution delivered via a pump.

We administered broad-spectrum prophylactic antibiotics before the procedure. During the procedure, patients received intravenous midazolam and meperidine. The procedure was performed by using a linear-array echoendoscope (GF-UCT 260-AL 10; Olympus Medical Systems, Tokyo, Japan) or a forward-viewing echoendoscope (GF-UCT 160J-AL 10; Olympus Medical Systems). To avoid major vessel injury, real-time Doppler imaging was used during the procedure. After insertion of the RFA electrode into the mass, the radiofrequency generator was activated to deliver 20 to 50 W ablation power. The ablation was performed for 10 seconds at one site and was repeated until the hyperechoic zone around the electrode tip sufficiently covered the tumor. Initially, ablation began at the right distal portion of the mass on the EUS image while the RFA electrode was withdrawn, and then the RFA electrode was reinserted, and ablation was repeated at the left side of the previous site.

A simple abdominal radiograph and blood tests for complete blood count, liver function tests, and serum amylase