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Case Report
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Successful Use of Endoscopically Applied Radiofrequency Ablation in the Management of Unresectable Bile Duct Cancer

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Abstract

Radio Frequency Ablation (RFA) has been used for many types of tumors, including tumors of the liver, esophagus, and rectum, among others. However, a limited number of studies have examined the use of endoscopically applied RFA (*via* Endoscopic Retrograde Cholangiopancreatography (ERCP)) to treat unresectable malignant biliary obstructions. Here, we describe a case of a patient who suffered from unresectable bile duct cancer with biliary strictures but had a life expectancy of more than 3 months and received endoscopically applied (ERCP-based) RFA therapy. No pancreatitis or cholecystitis was observed after the operation. The patient's TB, DB, and IB levels slowly decreased, and his appetite recovered. Ten days after the operation, he was discharged from the hospital. The patient was followed-up after his discharge and remained alive more than 1 year after the operation. Therefore, endobiliary RFA may be a safe therapeutic option for the treatment of malignant biliary obstructions in patients who cannot tolerate surgery. However, a multicenter randomized controlled trial is required to confirm the long-term benefits of RFA.

Keywords: ERCP; RFA; Malignant biliary obstruction; Endoscopic biliary drainage

Introduction

Radio Frequency Ablation (RFA), which achieves localized necrosis of a tumor and its surrounding tissue *via* the conduction of heat energy, has been widely used percutaneously and intraoperatively. In fact, RFA has replaced photodynamic therapy for many primary or secondary malignant tumors in the liver, esophagus, rectum, and other locations. However, a limited number of studies have examined the use of RFA to treat malignant biliary obstructions.

Self-Expanding Metal Stents (SEMS) have superseded plastic stents to become the mainstay palliative treatment for unresectable malignant bile duct obstructions among patients with life expectancies greater than 3 months [1]. However, 50% of patients with SEMS will exhibit stent occlusion within 4 months [2] due to tissue in growth or overgrowth, benign epithelial hyperplasia, biofilm deposition, sludge formation, and/or other phenomena. Ongoing and renewed biliary obstructions lead to significant morbidities and mortality [3]. Many different design features (such as the use of organic polymers to coat SEMS and the replacement of stainless steel with alloys, among others) have been explored in attempts to improve stent patency. However, stents that incorporate these characteristics exhibit greater migration rates and may induce pancreatitis and cholecystitis.

Endoscopically applied RFA has been used in the management of human malignant tumors in the esophagus, rectum, and other locations; in these contexts, the safety and efficacy of this treatment have been proven. However, the use of endoscopically applied RFA for biliary obstructions has rarely been described; in particular, only two studies have assessed this procedure in humans [4,5]. They performed ablations with a RITA 1500X radiofrequency generator (Angiodynamics, Latham, NY, USA) set to 7 watts to 10 watts and applied for 2 min at the level of the biliary stricture. A one-minute resting period after energy delivery was permitted before the catheter was moved. Biliary stents were systematically placed after RFA had been performed. Based on the results of these procedures, these authors concluded that RFA could be a safe palliative option for unresectable malignant biliary strictures. In the current report, we describe a case in which a patient was successfully managed using this method.

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Case Presentation

Clinical information

An 82-year-old man with painless jaundice for nearly 15 days accompanied by itching across the entire body, yellow urine and recent weight loss of 4 kg was hospitalized on October 16th, 2013. An enhanced MRI confirmed the presence of a distal bile duct carcinoma that had expanded into the intra-hepatic bile duct, the proximal extra-hepatic bile duct and the cystic duct. This enhanced MRI also revealed a soft tissue mass in the distal bile duct that could be strengthened. Blood examinations produced the following results for liver function parameters: ALT: 59.0 U/l; AST: 81.0 U/l; ALB: 25.2 g/l; TP: 52.7 g/l; TB: 309.7 μmol/l and DB: 228.2 μmol/l. Examination results also indicated that kidney function, clotting time and tumor marker-related antigen levels were normal. Because the patient had a history of chronic obstructive pulmonary disease and cor pulmonale, he was unable to tolerate surgery. After careful preoperative preparation, we selected RFA applied *via* Endoscopic Retrograde Cholangiopancreatography (ERCP) to resolve the patient's obstructive jaundice. This operation was performed on October 25th, 2013.

Intervention

ERCP was performed under standard operating conditions with Olympus TJF-260 duodenoscopes (Olympus, Tokyo, Japan). A cholangiogram was then obtained; this assessment confirmed the results observed from the enhanced MRI (Figure 1A); in particular, expansion to the intrahepatic bile duct, the proximal extrahepatic bile duct and the cystic duct was detected. Moreover, a stricture of approximately 1.5 cm in length and approximately 0.1 cm in diameter was present in the distal bile duct. Under fluoroscopic guidance, a Habib EndoHPB wire-guided catheter (Angiodynamics, Latham, NY, USA) was placed at the level of the biliary stricture.

The Habib EndoHPB catheter is a bipolar RFA probe that is 8 Fr, 1.8 m in length, compatible with standard side-viewing endoscopes (with a 3.2 mm working channel), and passes over 0.035-inch guidewires. The catheter, which has 2 ring electrodes that are 8 mm apart, with the distal electrode 5 mm from its leading edge, induces local coagulative necrosis across a length of 2.5 cm (Figure 1B). An RFA generator (1500 RF generator, RITA Medical Systems, Inc., Fremont, California) delivered energy at 400 KHz and 8 W for 2 min. There was a rest period of 1 min before the catheter was moved. After the RFA treatment, an uncovered SEMS (Wallstent; Boston Scientific, Natick, Massachusetts, USA) was deployed (Figures 1C-1E).

Results

The length of the treated stricture was 15.0 mm. The stricture diameter was 1.0 mm prior to RFA and 5.6 mm after RFA. No pancreatitis or cholecystitis occurred after the operation. Hepatoprotective treatments and nutritional support were administered to the patient, who gradually recovered. His TB level slowly decreased over time (Figure 2A), and his appetite returned to normal. He was discharged from the hospital 10 days after the operation. At that time, he exhibited the following liver function parameters: ALB: 29.4 g/l; TP: 60.0 g/l; TB: 44.15 μmol/l; and DB: 35.17 μmol/l. The patient was followed-up after he had left the hospital and reported experiencing good postoperative recovery. On June 11th, 2014, the patient presented with an intermittent fever with a maximum axillary temperature of 38.7°C. At that time, he exhibited the following liver function parameters: ALB: 54.4 g/l; TP: 94.0 g/l; TB: 64.15 μmol/l, and DB: 53.24 μmol/l. He exhibited no positive signs and was therefore diagnosed with a biliary infection. After 5 days of anti-inflammatory treatment, the patient's fever subsided, and he exhibited the following liver function parameters: ALB: 45.4 g/l; TP: 54.0 g/l; TB: 32.34 μmol/l, and DB: 28.12 μmol/l. On October 16th,

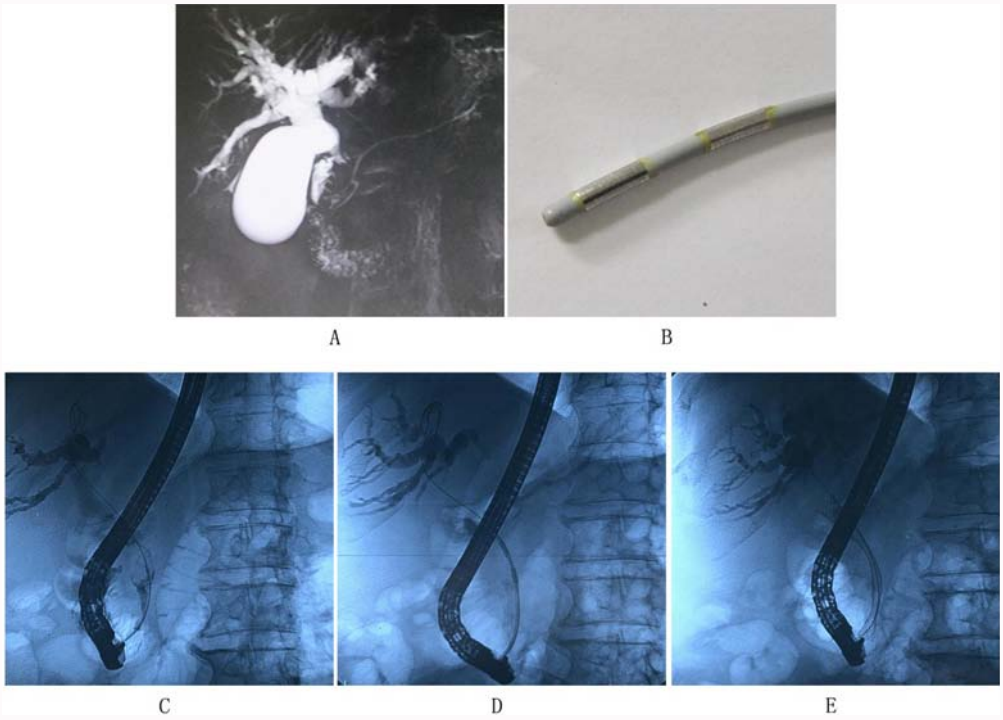

Figure 1: (A) MRCP shows the tumor of the bile duct. (B) The Habib EndoHPB catheter. (C) ERC shows the tumor of the bile duct. (D) RFA electrodes placed at the position of the tumor and RFA was given. (E) After RFA the SEMS was placed.

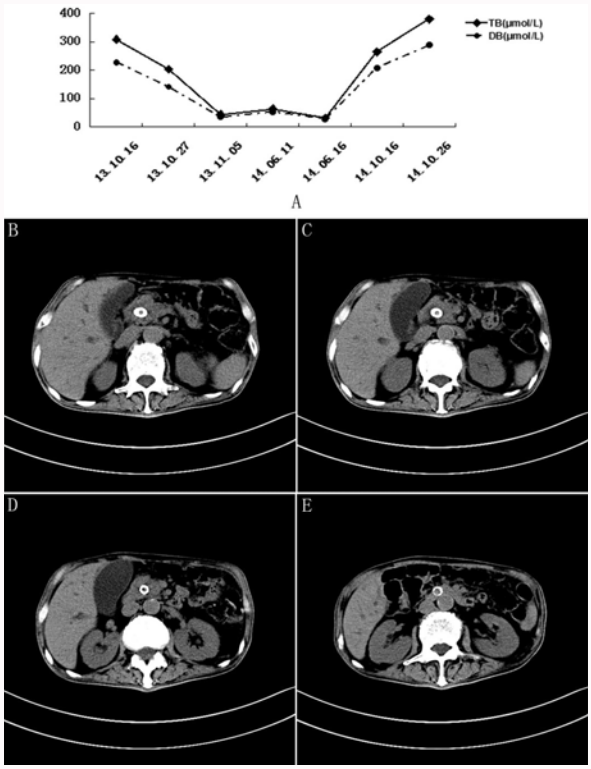

Figure 2: (A) The changes of TB and DB after operation. (B-E) CT scan revealed a tumor under the common bile duct.

2014, the patient returned to the hospital with fever and jaundice; at this time, his peak axillary temperature was 39.2°C. His liver function parameters were as follows: ALB: 203.4 g/l; TP: 165.0 g/l; TB: 264.87 μmol/l, and DB: 208.96 μmol/l. A CT scan revealed a tumor under the common bile duct (Figure 2B-2E). The patient had weakened; as a result, his family members refused any surgical treatment. Thirteen days later, the patient died of multiple organ failure.

Discussion

Endoscopic biliary decompression has become the preferred palliative technique for unresectable malignant biliary obstructions. SEMS offer longer palliation than plastic stents but can nonetheless become occluded due to tumor growth, sludge, and other factors. Therefore, long-term drainage continues to be a challenge for biliary practitioners.

RFA has been widely used in the liver, esophagus, rectum, and other tissues. However, the first reported examinations of endobiliary RFA were conducted in animals [4,5]. The initial experiences with endobiliary RFA in humans were described by the Steel AW group [5] and the Figueroa-Barojas group [4], and obtained encouraging results. In the present study, because the described patient had a history of chronic obstructive pulmonary disease and cor pulmonale, he was unable to tolerate surgery. After careful preoperative preparation, we decided to resolve the obstructive jaundice problem by applying RFA via ERCP, and we achieved satisfactory results.

In contrast to RFA treatments of liver tumors and esophageal RFA treatments of Barrett syndrome, the use of RFA within the bile duct does not cause superficial burns but could instead produce tissue damage at a deeper level [6]. RFA induced coagulative necrosis within a malignant biliary stricture will likely damage an adjacent healthy bile duct to an extent. The use of two electrodes results in a generally cylindrical heating pattern in the region between the two electrodes; thus, relative to RFA with a single electrode, RFA with two electrodes causes energy to be spread across a larger volume, with reduced spatial variation in the energy deposition. The optimal treatment for bile duct injuries in the situation detailed in this report has not been clearly established; however, reports have indicated that endoscopic biliary stent placement is the best treatment approach for traumatic or surgical bile duct injuries [7]. Therefore, in the described case, we inserted SEMS after performing RFA.

The patient did not experience any of the potential complications that have been identified in animal models, such as the extension of the RFA burn to local structures, difficulty reintroducing catheters into the bile duct after RFA, or hemorrhage and abscess formation at the RFA site. In this regard, our results are similar to the findings of Steel Fleischer et al. and Figueroa-Barojas et al. [4,8]. However, in our patient, gallbladder cardiac reflex occurred during the application of RFA. In particular, his heart rate dropped from 72 beats/min to 30 beats/min. At this time, we stopped RFA and injected 2 mg atropine. Subsequently, the patient's heart rate recovered. Although, this study demonstrated that endobiliary RFA treatment might be the most effective therapeutic approach for unresectable biliary obstructions, there remain many unresolved issues (such as the optimal duration and maximal power for energy transfer) that require further research.

Endobiliary RFA appears to be an efficient and safe therapeutic strategy for treating unresectable malignant biliary obstructions. However, additional multicenter investigations involving larger samples remain necessary.

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