CLINICAL STUDY

Safety and Efficacy of Radiofrequency Ablation for Hepatic Metastases from Gastrointestinal Stromal Tumor

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ABSTARCT

Purpose: To evaluate the safety and efficacy of radiofrequency (RF) ablation for hepatic metastases from gastrointestinal stromal tumor (GIST).

Materials and Methods: Retrospective review of a prospectively maintained database was performed between February 2002 and November 2010 and identified 29 patients with GISTs (18 male; age range, 35–77 y; median age, 61 y) who had undergone ultrasound-guided RF ablation for metastases detected in the liver. All patients had been treated with imatinib mesylate. Indications for RF ablation were tumor progression during medical therapy or the development of drug resistance after initial tumor control. The average number of target lesions per procedure was 2.3 (range, 1–8), and mean lesion diameter was 1.3 cm (range, 0.4–3.6 cm).

Results: For 69 lesions among 86 hepatic metastases, RF ablation was successfully performed according to the protocol currently in use. In 17 hepatic metastases in 13 patients, RF ablation was not performed because of poor lesion visibility or possible thermal damage to adjacent organs. Major complications included bleeding at the ablation site in one patient and peritoneal seeding near the ablation tract in another patient. Technical effectiveness was achieved for 66 of 69 lesions (95.6%). The median follow-up period was 33.1 months (range, 12.3–108.6 mo). Four of 66 lesions (6%) showed local recurrence at 3.2–10.5 months. Four patients died of disease progression. The median overall survival period was 90.2 months (range, 12.3–108.6 mo).

Conclusions: RF ablation appears to be a safe and effective treatment for hepatic metastases of GIST when medical therapy fails.

ABBREVIATIONS

GIST = gastrointestinal stromal tumor, LTP = local tumor progression, RF = radiofrequency

Gastrointestinal stromal tumors (GISTs) are the most common nonepithelial tumors of the gastrointestinal tract (1). Incidences of distant metastases from GIST have been reported as 23%–47% (2–6). Among distant metastases, 20%–60% occur in the liver (2–4). Imatinib mesylate has been regarded as the first-line therapy for metastatic GISTs (7–10). Unfortunately, approximately 15% of treated patients have tumors that show no response to this drug, and drug resistance develops after an average of 2 years of treatment in a proportion of patients whose tumors do exhibit a response (1,11). Surgical resection is an effective treatment for progressive liver metastases following imatinib treatment (12,13). However, few patients are surgical candidates as a result of tumor multiplicity and general condition. Radiofrequency (RF) ablation has been shown to achieve effective and reproducible local tumor control with minimal morbidity in patients with small hepatocellular carcinoma (HCC) and metastases (14). RF ablation can also be an alternative therapy for patients with hepatic GIST metastases.

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None of the authors have identified a conflict of interest.

J Vasc Interv Radiol 2015; 26:1797–1802

http://dx.doi.org/10.1016/j.jvir.2015.09.002

To our knowledge, there have been only a few reports regarding the safety and efficacy of RF ablation in hepatic metastases from GIST, and with only small numbers of patients (2,15–17). The purpose of the present study is to evaluate the safety and efficacy of RF ablation in the treatment of hepatic metastases from GISTs.

MATERIALS AND METHODS

Patient Population

The institutional review board of Asan Medical Center approved this retrospective review of patients' medical and imaging records, and informed consent was waived. We retrospectively reviewed our prospectively maintained database and identified patients with GISTs who had undergone ultrasound (US)-guided RF ablation for metastases in the liver between February 2002 and November 2010. Twenty-nine patients with GISTs with liver metastases were treated with RF ablation **Table**. The median age of these patients was 61 years (range, 35–77 y). There were 18 men and 11 women.

The primary GIST sites were the stomach (n = 12), small bowel (n = 12), rectum (n = 2), and retroperitoneum (n = 3). Primary GIST was resected in 27 patients. Two patients who had distant metastases at the time of their initial diagnosis underwent chemotherapy without surgical resection. Partial hepatic resection had been performed for liver metastases in seven patients, and ethanol injection had been performed in one patient in addition to liver RF ablation. All patients had been treated with imatinib mesylate (Gleevec; Novartis, East Hanover, New Jersey). The indications for RF ablation were tumor progression during medical therapy (n = 4) or the development of drug resistance after initial tumor control (n = 25). The average number of index tumors per procedure was 2.3 (range, 1–8), and the mean lesion diameter was 1.3 cm (range, 0.4–3.6 cm).

RF Ablation Technique

RF ablation was performed percutaneously (n = 24) or intraoperatively (n = 5) by three interventional radiologists (P.N.K., Y.M.S., H.J.W.) with 10, 10, and 7 years, respectively, of clinical experience in performing liver tumor ablation. When RF ablation was performed percutaneously, the patient was under conscious sedation and had been given local anesthesia. US was used as the guidance modality in all cases. A single or cluster-type internally cooled electrode (RF Medical, Seoul, Korea) was used for RF ablation. For tumors smaller than 2 cm in diameter, a single electrode with a 3-cm exposed tip was used. For larger lesions, a cluster electrode or multiple overlapping insertions of a single electrode were used. RF current was applied for 12 minutes with a 200-W generator (RF Medical) set to deliver maximum power in the automatic impedance-control mode. The electrode was positioned to achieve complete ablation of the tumor and at least a 0.5–1-cm ablation margin whenever possible.

Follow-up

After RF ablation, all patients underwent dynamic contrast-enhanced computed tomography (CT) within 24 hours to assess technical success. To evaluate procedure efficacy, dynamic contrast-enhanced CT was performed within the next 1–3 months. Follow-up examinations were repeated within a 3–6-month interval. CT was performed by using a four-detector CT scanner (LightSpeed QX/i; GE Healthcare, Milwaukee, Wisconsin). Precontrast CT scans were first obtained, followed by contrast-enhanced CT scans (contrast medium injection rate, 3.0 mL/s). The contrast-enhanced CT scans were obtained during the hepatic-arterial phase, the portal-venous phase, and the equilibrium phase.

Definitions and Evaluation of Data

The reporting standards of the Society of Interventional Radiology were used to define success, outcomes, and complications (18). Technical success was achieved when a treated tumor was ablated at the time of the procedure. Technical effectiveness was defined as complete ablation of the tumor shown on imaging follow-up 1–3 months after RF ablation. As the lesions commonly appear hypoattenuating before and after ablation, full coverage of the index tumor by the nonenhancing ablation zone was regarded as complete ablation.

Local tumor progression (LTP) describes the appearance of tumor foci at the edge of the ablation zone after at least one contrast-enhanced follow-up study documenting adequate ablation. LTP-free survival rates and overall patient survival rates were calculated by Kaplan–Meier method. The LTP-free survival period was defined as the interval, in months, between the initial RF ablation treatment and any follow-up imaging showing LTP. The overall patient survival period was defined as the interval, in months, between the initial RF ablation and the patient's death.

RESULTS

Technical Success and Technical Effectiveness

RF ablations were completed in all sessions according to our planned protocol described earlier (*Materials and Methods*). In 13 patients, RF ablation was not performed in all hepatic metastases. The total number of untreated metastases was 17. The mean diameter was 1.1 cm (range 0.3–1.5 cm). Among 17 untreated lesions, 11 were invisible on US and six were not ablated because of the high risk of major complications. RF ablation was performed for 69 lesions. In five patients, a residual