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Radiofrequency ablation of unresectable liver tumors: factors associated with incomplete ablation or local recurrence

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KEYWORDS:
Liver tumor;
Radiofrequency ablation;
Incomplete ablation;
Local recurrence

Abstract

BACKGROUND: Radiofrequency ablation (RFA) of liver tumors is associated with a risk of incomplete ablation or local recurrence.

METHODS: One hundred sixty-eight patients with 311 unresectable liver tumors were included. Effects of different variables on incomplete ablation and local recurrence were analyzed.

RESULTS: There were 132 hepatocellular carcinomas and 179 liver metastases. Tumor size was 24 (±13) mm. Two hundred twenty-six tumors were treated percutaneously, and 85 through open approach (associated with liver resection in 42 cases). There was no mortality. Major morbidity rate was 7%. Incomplete ablation and local recurrence rates were 14% and 18.6%. Follow-up was 29 months. On multivariate analysis, factors associated with incomplete ablation were tumor size (>30 mm vs ≤30 mm, $P = .004$) and approach (percutaneous vs open, $P = .0001$). Factors associated with local recurrence were tumor size (>30 mm vs ≤30 mm, $P = .02$) and patient age (>65 years vs ≤65 years, $P = .05$).

CONCLUSIONS: RFA is effective to treat unresectable liver tumors. However, there is a risk of incomplete ablation when percutaneously treating tumors >30 mm. When tumor ablation is completely achieved, the main factor associated with local recurrence is tumor size >30 mm.

Surgical resection is currently the only therapeutic option with potential curative effect for liver malignancies. However, in more than 70% of cases surgery is contraindicated due to poor liver reserve, comorbid health conditions, or tumor stage.[1–3] Alternative treatments to control the disease in patients with unresectable hepatic primary or metastatic malignancies have been proposed with encouraging results.[4–6] Among these different ablative techniques, radiofrequency ablation (RFA) has gained high acceptance and has become one of the most popular technique for both hepatocellular carcinoma (HCC) and liver metastases.[7–9]

However, to date, RFA cannot be considered superior to

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liver resection, and is indicated only for patients who are not candidates for liver resection.[10] The main areas of concern regarding RFA are the risk of incomplete tumor ablation and the risk of local recurrence. The aim of the present study is to assess factors associated with incomplete ablation or local recurrence in a series of consecutive patients treated in a tertiary referral center.

Patients and Methods

In this retrospective study, 163 patients with a total of 311 primary or secondary hepatic malignancies treated by RFA in a tertiary referral center between January 2000 and March 2007 were reviewed.

Indications for RFA

All patients underwent a complete and detailed exploration including contrast computed tomography (CT) and magnetic resonance imaging (MRI), as well as tumor markers (alpha-fetoprotein or carcinembryonic antigen). Tumor size was defined as the maximum diameter of the tumor as evaluated at the CT scan. The indications for RFA were extensively discussed at the multidisciplinary meeting and only patients not eligible for liver resection underwent RFA. The main reasons forbidding patients to undergo liver resection were poor medical status and/or poor liver reserve. Exclusion criteria for RFA included: eligibility for liver resection, extrahepatic disease, more than 5 intrahepatic nodules, maximum tumor size >7 cm, and previous history of bilioenteric anastomosis.

RFA was performed either percutaneously or intraoperatively based on tumor location, tumor size, and also on the need to perform an associated liver resection. The percutaneous approach was preferred in case of small tumors located away from the liver capsule and portal triad. The percutaneous RFA was performed by the interventional radiologist under general anesthesia, and by ultrasound or CT guidance. In case of surgical approach, RFA was performed either through laparoscopy or laparotomy, and was associated in some cases to liver resection.

All RFA treatments were performed with a standard protocol using the RITA 1500× generator and multiple array probe (RITA Medical Systems, Angiodynamics, New York, NY).

Postoperative evaluation and follow-up

All patients underwent a CT scan at 6 weeks after RFA to assess the effectiveness of the procedure and every 3 months thereafter. Complete ablation was defined as complete necrosis of the tumor, without any contrast enhancement at any phase of the exploration. Incomplete ablation was defined as the persistence of vascular enhancement peripheral or at the treatment site at the first follow up scan (6 weeks). Local intrahepatic recurrence was defined as tumor recurrence peripherally or at the treatment site on subsequent CT scans following documented complete ablation on the first follow up scan (at 6 weeks). Distant intrahepatic recurrence was defined as tumor that appeared into the liver parenchyma away from any previously treated area.

Data analysis

Statistical analysis was performed using StatView (SAS Institute, Inc, Berkeley, CA). Results were expressed as either median (range) or mean ± SD. Differences in means between subgroups were compared using the Student *t* test. Comparisons between categorical variables were analyzed using the chi-square test. Mann–Whitney-*U* test was used to evaluate differences between continuous variables. Multivariate analysis was performed by entering the significant factors identified in univariate analysis into a logistic regression model. The results are reported as odds ratios (OR) with 95% confidence intervals (CIs). *P* values <.05 were considered statistically significant.

Results

A total of 163 patients with liver malignancies underwent RFA during the study period. There were 112 men (69%) and 51 women (31%) with a median age of 65 years (range 35–84 years). Seventy-six (46.6%) patients had HCC associated to liver cirrhosis, and 87 (53.4%) patients had metastatic malignancies of which 61 were colorectal liver metastases (70%). The median number of tumor per patient was 1.3 (range 1–5).

A total of 311 tumors were treated in these 163 patients. Among these tumors, 132 (42%) were hepatic primary (HCC), and 179 (58%) were liver metastases. RFA was used to treat a single tumor in 76% of cases (187 nodules). Two nodules were treated during the same procedure in 15% of cases, 3 nodules in 6%, 4 nodules in 2%, and finally 5 nodules were treated in only 1 case during the same procedure. Median tumor size of the largest ablated tumor was 24 mm in diameter (range 7–70 mm).

Among these 311 tumors treated with RFA, 226 (72%) were performed percutaneously and 85 (28%) were performed through open or laparoscopic approach which was associated with liver resection in 42 cases. Most HCC underwent percutaneous approach (125 of 132, 94.7%), whereas only 98 liver metastases (55%) were treated percutaneously. On the contrary, the open approach was preferred for 7 HCC (5.3%) only and for 81 liver metastases (45%). In these latter cases, liver resection was associated to intraoperative radiofrequency ablation in 42 cases.

There was no mortality. The overall morbidity rate was 26%, of which 7% represented major complications including abscesses (n = 5), biliary fistulae (n = 2), biliary stenosis (n = 1), hemorrhage (n = 2), portal vein thrombosis (n = 3), liver failure (n = 3), cardiac failure (n = 5), and needle track tumor seeding (n = 2).