Percutaneous Computed Tomography–guided High-Dose-Rate Brachytherapy Ablation of Breast Cancer Liver Metastases: Initial Experience with 80 Lesions

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ABSTRACT

Purpose: To analyze initial experience with computed tomography–guided high-dose-rate brachytherapy (CT-HDRBT) ablation of breast cancer liver metastases (BCLM).

Materials and Methods: Between January 2008 and December 2010, 37 consecutive women with 80 liver metastases were treated with CT-HDRBT in 56 sessions. Mean age was 58.6 years (range, 34–83 y). Treatment was performed by CT-guided applicator placement and high-dose-rate brachytherapy with an iridium-192 source. The mean radiation dose was 18.57 Gy (standard deviation 2.27). Tumor response was evaluated by gadoxetic acid–enhanced liver magnetic resonance (MR) imaging performed before treatment, 6 weeks after treatment, and every 3 months thereafter.

Results: Two patients were lost to follow-up; the remaining 35 patients were available for MR imaging evaluation for a mean follow-up time of 11.6 months (range 3–32 mo). Mean tumor diameter was 25.5 mm (range 8–74 mm). Two (2.6%) local recurrences were observed after local tumor control for 10 months and 12 months. Both local progressions were successfully retreated. Distant tumor progression (new metastases or enlargement of nontreated metastases) occurred during the follow-up period in 11 (31.4%) patients. Seven (20%) patients died during the follow-up period. Overall survival ranged from 3–39 months (median 18 months).

Conclusions: CT-HDRBT is a safe and effective ablative therapy, providing a high rate of local tumor control in patients with BCLM.

ABBREVIATIONS

BCLM = breast cancer liver metastases, CT-HDRBT = computed tomography–guided high-dose-rate brachytherapy, CTV = clinical target volume, SBRT = stereotactic body radiotherapy

Breast cancer is the most common malignant disease affecting women in Western countries, with > 1 million new diagnoses annually (1). Despite improved screening modalities, about 7% of patients with newly diagnosed breast cancer present with metastatic disease (1). The liver is the only site of distant disease in 5%–25% of these patients, and more than half of all patients with breast cancer develop liver metastases at some point of their disease (2,3). The occurrence of breast cancer liver metastases (BCLM) implies a poor prognosis with a reported spontaneous median survival of < 6 months and a maximum of 24 months when chemotherapy or hormone therapy is used (4). The role of surgical resection of BCLM is still debated (5). Several studies have shown that surgical resection may prolong survival in selected patients (3). Nevertheless, liver metastases from breast cancer are considered a systemic disease (in contrast to liver metastases from colorectal cancer) with poor prognosis. Many patients receive only salvage hormone therapy or chemotherapy or both (5,6).

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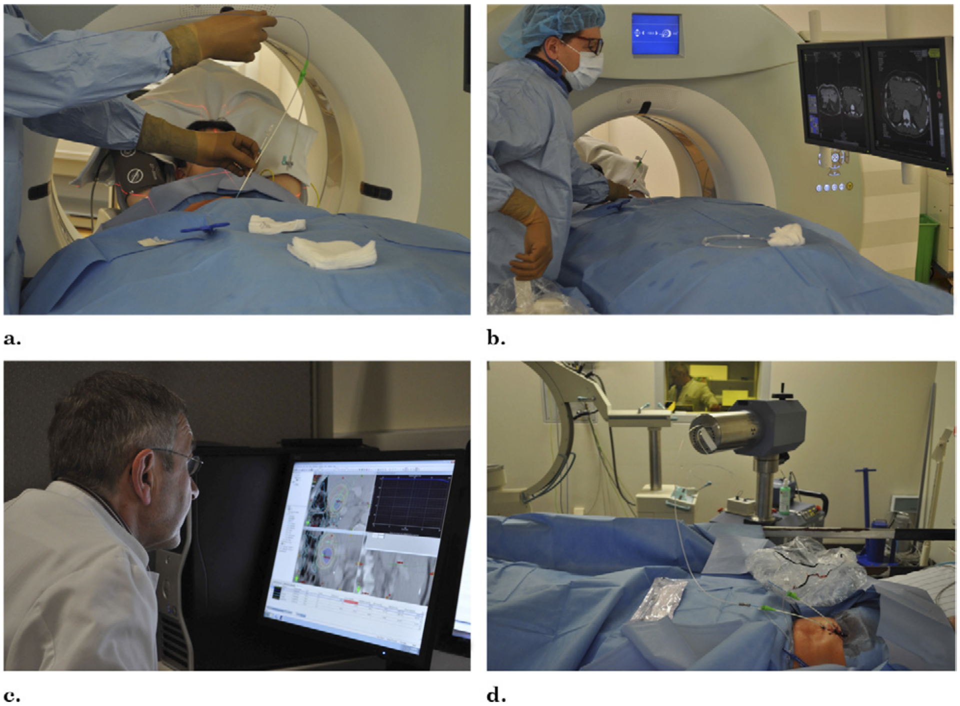

Figure 1. **(a, b)** Catheter implantation under CT fluoroscopy. **(c)** Computer-based three-dimensional treatment planning on a dedicated workstation. **(d)** High-dose-rate irradiation in afterloading technique using an iridium-192 radiation source.

In the last decade, interventional oncology techniques have gained more attention in the management of patients with primary and secondary hepatic malignancies (7–9). Many studies have shown local interventions to be effective in treating hepatocellular carcinoma and liver metastases from colorectal cancer (7). Numerous more recent studies have shown the safety and efficacy of thermal ablation (radiofrequency [RF] ablation, laser-induced thermotherapy) for the treatment of BCLM (10–14).

Computed tomography–guided high-dose-rate brachytherapy (CT-HDRBT) is a new therapeutic approach in which an iridium-192 source is temporarily inserted through a catheter into the tumor under CT guidance. Initial clinical studies showed that CT-HDRBT is effective for the local ablation of liver metastases from colorectal carcinoma and other abdominal tumors, with excellent local tumor control rates and therapeutic effects apparently not dependent on tumor location, vascularization, or size (in contrast to thermal ablative techniques) (15,16). We report our initial experience with CT-HDRBT of 80 BCLM in a series of 37 consecutive patients. Our purpose was to evaluate the technical success and clinical outcome of CT-HDRBT for the ablation of BCLM with the goal of local tumor control and to compare our results with results of other ablation techniques reported in the literature.

MATERIALS AND METHODS

Between January 2008 and December 2010, 37 women with 80 unresectable breast cancer liver metastases underwent CT-HDRBT at our institution. All patients were referred to us by their gynecologists or oncologists and discussed by the interdisciplinary institutional tumor board. Written informed consent was obtained from each patient before the procedure.

Criteria to perform the intervention included liver function status at Child-Pugh class A or B, total serum bilirubin < 2 mg/dL, platelet count $> 50{,}000/\mu L$, prothrombin time $> 50\%$, international normalized ratio $>$ 1.5, and partial thromboplastin time < 50 seconds. If indicated, hemostatic function was corrected (eg, platelet concentrates), and any ascites was drained before the intervention. Further exclusion criteria were evidence of progressive extrahepatic disease and more than five liver metastases. Stable skeletal metastases were not a contraindication to CT-HDRBT. This retrospective study was approved by the local ethics committee.

Treatment Planning and Interventional Technique

Standard treatment planning consisted of a contrast-enhanced magnetic resonance (MR) imaging examination of the liver using gadoxetic acid (Gd-EOB-DTPA; Primovist; Bayer HealthCare Pharmaceuticals, Berlin, Germany) on the day before the procedure to evaluate technical feasibility. The interventional technique consisted of three steps: (*i*) CT-guided catheter implantation, (*ii*) computer-based three-dimensional treatment planning, and (*iii*) subsequent high-dose-rate irradiation in afterloading technique (Fig 1**a–d**).