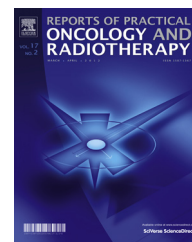




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Original research article

Radiosurgery for liver metastases. A single institution experience

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ABSTRACT

Aim: To report our initial results on the use of radiosurgery for treatment of liver metastases.

Background: In recent years there has been increasing interest in the use of stereotactic body radiation therapy to treat metastatic disease to the liver as an alternative to interventional procedures.

Materials and methods: Between November 2008 and June 2015 a total of 36 LINAC-based radiosurgeries using VMAT were performed in 27 patients with liver metastases from 10 different primary sites. Doses ranged from 21 Gy to 60 Gy in 1 to 5 fractions. In all patients the volume of liver receiving less than 15 Gy was more than 700 cc. The volume treated with the prescription dose ranged from 1 cc to 407 cc with a median of 58 cc. All patients but one received systemic treatment.

Results: Overall median survival for the entire group is 9 months (ranging from 1 to 67 months). Local recurrence free survival ranged from 4 to 67 months with a median of 14 months.

Twenty patients (80%) survived more than six months. Three patients treated for oligometastases were alive after 3 years. Grade 0 toxicity was encountered in 22/27 patients, Grade 1 toxicity in 5/27 and only 1/27 patient experienced Grade 2 toxicity. No patient experienced grade 3–4 toxicity.

Conclusion: Based on these initial results we conclude that SBRT for treating liver metastases with radiosurgery is safe and effective for treating one or multiple lesions as long as normal tissue constraints for liver are respected.

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1. Background

Many patients with advanced cancer present with liver metastases resulting in substantial morbidity and mortality. Chemotherapy is a standard palliative treatment for most of them, often providing transient responses and increased overall survival. In selected oligometastatic patients, local treatment can lead to long disease-free intervals and even permanent disease control. Surgery remains the gold standard for early metastatic focal disease. However, most patients will not be surgical candidates. For these patients, alternative targeted therapies have been developed. One of these, stereotactic body radiotherapy (SBRT), presents an attractive non-invasive option for selected patients with limited hepatic involvement.¹

SBRT is a form of highly precise radiotherapy using high dose of radiation in 5 fractions or less, (extreme hypofractionation) with steep dose distributions tightly covering the tumor, with rapid dose fall off that requires reproducible immobilization, accounting for tumor motion during treatment planning and delivery.²

The liver is a common site for metastases, especially from carcinomas of the colon, lung and breast.³ Liver is the only site of metastatic disease in patients with colorectal cancer in as many as 40% of patients. Fifteen to twenty-five per cent of patients present with liver metastases at the time of diagnosis and this synchronous disease carries the worst prognosis. It is estimated that as many as 55% of patients develop liver metastases during the course of their illness.⁴

Metastatic spread to the liver is a frequent event in a natural course of many common solid tumors.⁵⁻⁷ Primary tumor

site, histology, extent of liver metastases and the presence of metastatic spread profoundly affect the prognosis.

Stereotactic radiotherapy delivered either as a single fraction or hypofractionated treatment has emerged as a promising alternative to surgical or interventional options in metastatic disease to the liver.⁸⁻¹³ A treatment scheme focusing on an effective focal radiation is indicated in early phases of disease and after proper patient selection. It can also be used successfully in palliative cases, especially with other metastatic sites present combined with systemic treatment.¹⁴

2. Aim

The purpose of this study is to report our initial results on the use of linear accelerator-based radiosurgery as a feasible alternative for the treatment of liver metastases in patients that refuse or are not candidates for surgery.

3. Material and methods

From November 2008 to July 2015, twenty-seven patients with liver metastases were treated with SBRT at one single institution (Figs. 1-3). There were 12 males and 15 females with ages ranging from 42 to 83 years old with a median of 67 and a mean of 66 years. Tumors originated from 10 primary sites. Lung, breast and colorectal cancer were the most common primary sites with 7, 5 and 5 patients, respectively (Table 1). Six patients were oligometastatic, defined as patients who presented with 5 or fewer metastases at any site and with a Karnofsky status (KPS) higher than 70.^{15,16}

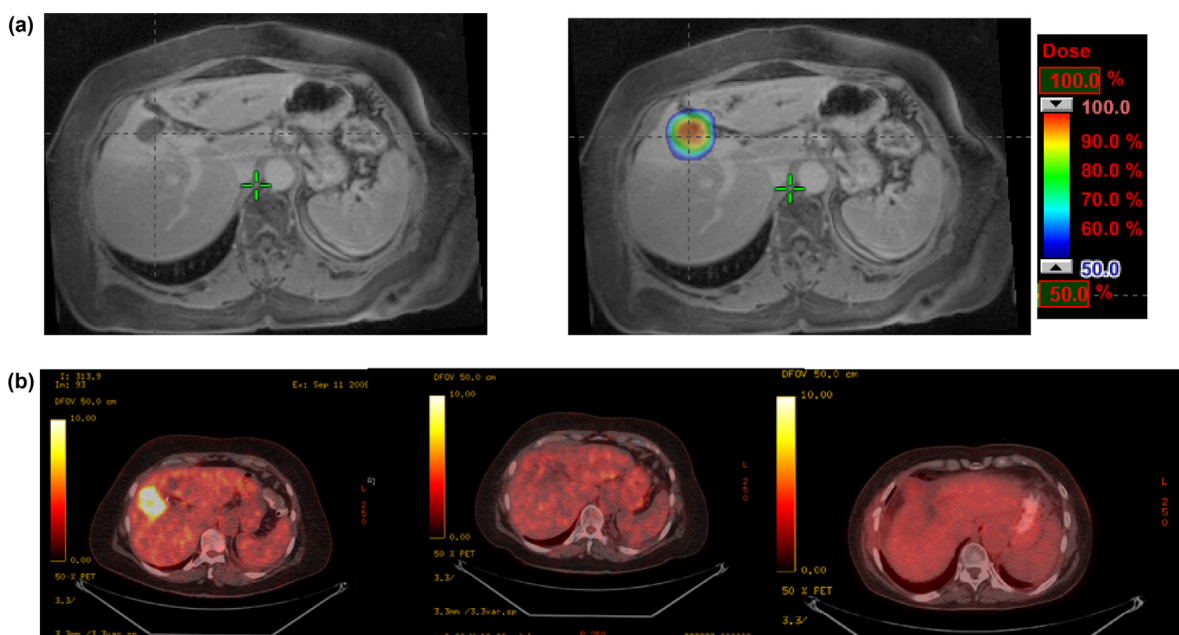


Fig. 1 – 72-Year old female with liver metastases from NSCLC. (a) Diagnostic abdomen MRI and dose in color wash in planning treatment using MRI fusion. Dose: integrated boost (12 Gy in the periphery and 15 Gy in the center of the lesion) \times 3 fractions. (b) PEC CT at diagnosis and consequently follow-up at 3 months, 5 years and 11 months after SBRT completion, respectively, showing complete response.

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