Case report

# Interstitial brachytherapy for liver metastases and assessment of response by positron emission tomography: a case report

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**Abstract**

For liver metastases (LM), image guided percutaneous ablative procedures such as radiofrequency ablation (RFA), laser induced thermal therapy (LITT) and trans-arterial chemo-embolisation (TACE) are increasingly being used because they are relatively safer, less invasive and equally effective. CT scan guided interstitial brachytherapy (IBT) with a single large dose of radiation by high dose rate (HDR) brachytherapy is a novel technique of treating LM and has shown good results. Positron emission tomography (PET) scan may provide better information for assessing the response to IBT procedures. We hereby report a case of LM that was treated by HDR IBT and PET scan was done in addition to CT scan for assessing the response.

J Contemp Brachyther 2010; 2, 3: 114-116
DOI: 10.5114/jcb.2010.16922

**Key words:** liver metastases, interstitial brachytherapy, PET scan.

## Purpose

Surgical resection is the standard procedure for LM [1]. Non surgical treatments like RFA, LITT are alternate methods of treatment in patients with medically or surgically inoperable lesions [2]. Even for operable lesions, image guided percutaneous ablative procedures are increasingly being used since they are relatively safer and equally effective [3]. IBT is a novel technique of treating LM which has shown good results [4]. It is preferred over the other ablative techniques in patients with larger lesions (> 5 cm) or closer to large vessels which are less likely to be ablated due to heat sink effect [5,6]. The IBT consists of insertion of single or multiple percutaneous needles in the lesion under ultrasonography (USG) or CT scan guidance and connected to remote after loading brachytherapy machine for delivering a single HDR dose of about 12-20 Gy. Due to limited experience with large single doses of IBT in oncology, radiological response on USG/CT/MRI scans may not predict the status of tumor viability. Single large doses of HDR IBT may take longer time than the conventional fractionated radiation therapy techniques and may show persistent shadow without any tumor viability. PET which is a functional imaging device, largely applicable in oncological practice, could provide better information for response assessment.

## Case history

In April 2008, a 67-year-old male patient was presented to our clinic as a diagnosed case of carcinoma of stomach for which he underwent radical gastrectomy in 1998 in a different hospital. General physical examination and hematological investigations including liver function tests were within normal limits. CT scan evaluation showed a metastatic lesion in segment V measuring 2.0 × 1.8 cm. Fine needle aspiration cytology (FNAC) examination of this lesion revealed features suggestive of metastases from adenocarcinoma. PET-CT scan (Fig. 1A,B) showed an ill defined, solid, hypodense mass measuring 2.0 cm in segment V of liver with increased FDG uptake (Standard Uptake Value [SUV] of 7.8). Since patient was declined for surgery, we decided to treat him with HDR IBT under CT guidance. The procedure was carried out in CT scan room (Siemens Medical System, Erlanger, Germany) under local anesthesia (2% xylocaine). In the breath hold position, a single 16 gauze, blind end, stainless steel brachytherapy needle was inserted in the center of lesion through the percutaneous route. The needle tip was advanced 1.0 cm beyond the lesion since the 0.8 cm of the needle tip was blind.

Brachytherapy planning was performed using PLATO planning system, version 14.1 (Nucletron, Veenandaal, Netherlands) with slice thickness of 2.5 mm. Target lesion and normal liver were delineated. Treatment plan was generated for dose of 12 Gy prescribed at periphery of the lesion. The treatment was delivered in a single fraction on HDR remote afterloading unit (Microselectron) and lasted for 20 minutes. The needle was removed immediately

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Received: 29.08.2010
Accepted: 27.09.2010
Published: 30.09.2010

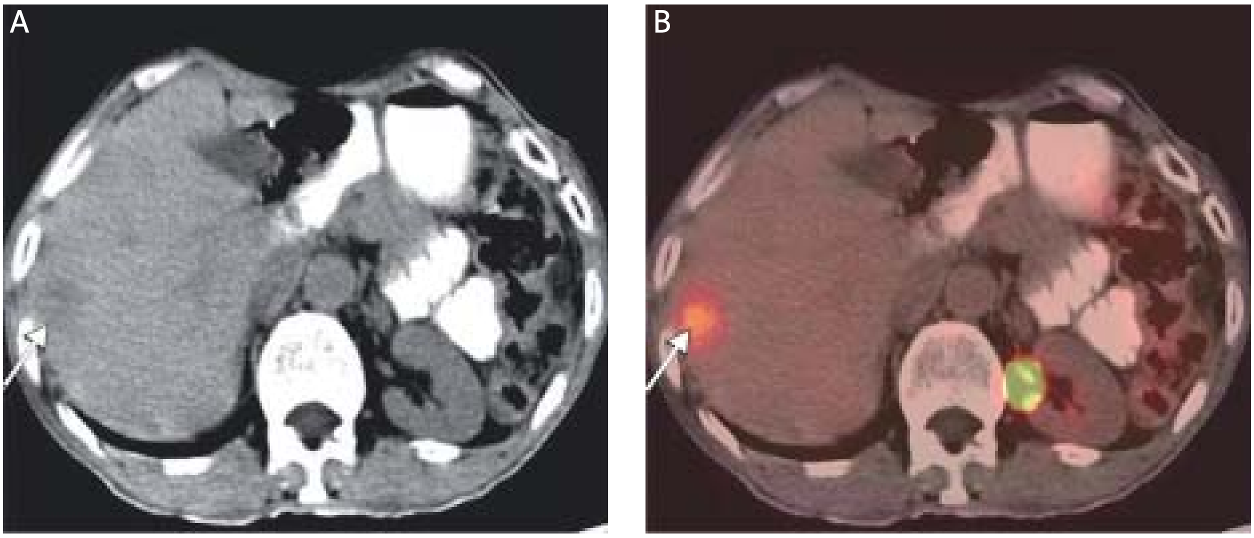


**Fig. 1.** Pretreatment PET-CT scan images. CT scan image (A) shows an ill defined, solid, hypodense mass measuring 2 cm in segment V of liver. PET scan image (B) shows increased FDG uptake with SUV of 7.8 in the same region

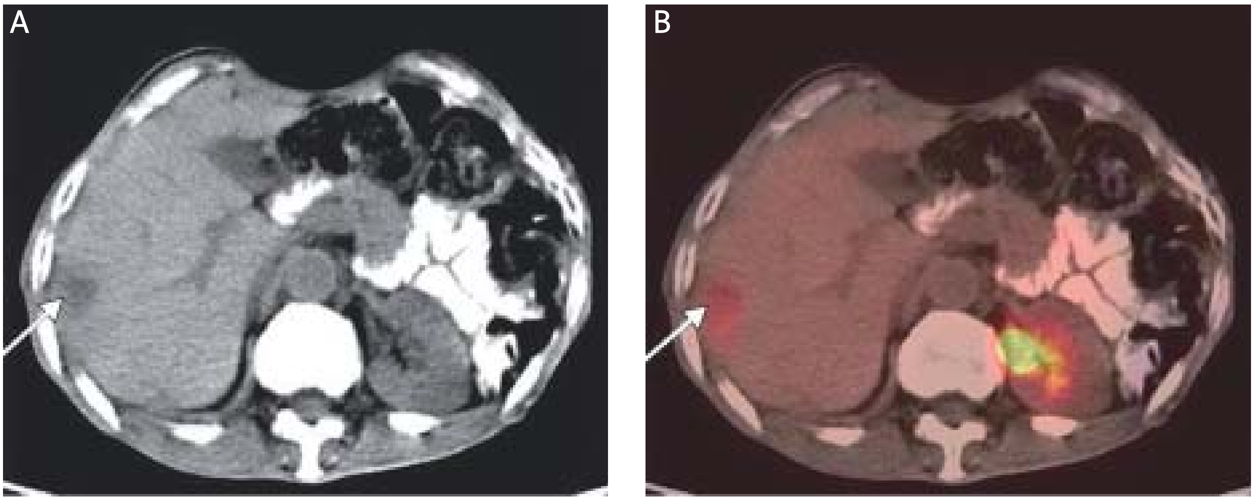


**Fig. 2.** Post brachytherapy PET-CT scan images. CT scan (A) shows no significant change in the size of the mass, however it had developed a necrotic area. PET scan image (B) shows no significant FDG uptake in the lesion (SUV 2.3)

afterwards. There was no perioperative complication during the overnight indoor stay.

A post brachytherapy PET-CT scan (Fig. 2A,B) was done in November 2008. The CT image (Fig 2A) did not show significant change in the size of the mass, however PET imaging (Fig. 2B) showed no significant FDG uptake (SUV; 2.3), suggesting no viable tumor.

## Discussion

The liver is one of the organs commonly involved with metastases from various primary malignancies. Surgical resection of LM is the only potentially curative modality, but it is possible in only 20 percent of patients [1]. CT guided HDR IBT is a new treatment technique for LM with only limited studies [7,8] in the literature reporting local control rates of 87-93%; similar to other ablative therapies [2]. There is no clear consensus about which imaging technique is the most reliable in order to assess the response to ablative therapies. Since the edema and necrosis caused by these therapies makes it difficult to assess the accurate response to these therapies on the basis of conventional CT/MRI scans [9].

PET has recently been used for response assessment to RFA and SIRT [9,10] and has been found very useful. However, it has not been tried for IBT since this form of therapy is relatively rare in use. IBT is advantageous over RFA because it is not affected by nearby blood vessel or size of the lesion. Compared to EBRT treatment methods, IBT dosimetry is not affected by respiratory movements since the implanted needle moves with target. Therefore, it delivers the desired dose to the target lesion accurately and minimal dose to the surrounding liver parenchyma which has limited radiation tolerance. So far, IBT for LM had been used in two studies both by Ricke *et al*. [7,8]. PET scan was used in none of these two studies. In their first study [7], 19 patients of LM were treated by IBT dose of 17 Gy (range 12-25 Gy) and assessed response by MRI scan. They observed local control rate of 93% at 1 year. Two patients (10%) experienced severe side effects, one had obstructive jaundice due to irradiation edema and the other had intra-abdominal hemorrhage.

In the second study by Ricke *et al.* [8], authors treated 37 patients with mean tumor size of 4.6 cm (ranged 2.5–11 cm) with either HDR IBT alone or in combination with thermal ablation. A minimal dose of 17 Gy inside the tumor margin was applied (ranged, 10-20 Gy). Severe complications were recorded in 2 patients (5%). The local control rate after 6 months was 87% and 73% for IBT alone and combined treatment respectively.

The decision of using IBT in our patient was based on the patient's refusal for surgery. We used an HDR IBT dose of 12 Gy in view of the small lesion size (2 cm) and it is the first report in literature, where PET scan has been used for assessing response to HDR IBT for LM.

On the basis of our case report and the only two studies available in the literature by Ricke *et al.* [7,8], we conclude that CT guided HDR IBT is safe and effective alternative to ablative therapies for treating LM, and PET-CT scan, as compared to CT scan, provides better information for response assessment.

## References

1. Bentrem DJ, Dematteo RP, Blumgart LH. Surgical therapy for the metastatic disease to the liver. *Ann Rev Med* 2005; 56: 139-156.
2. Dick EA, Taylor-Robinson SD, Thomas HC et al. Ablative therapy for liver tumors. *Gut* 2002; 50: 733-739.
3. Fong Y, Salo J. Surgical therapy of hepatic colorectal metastasis. *Semin Oncol* 1999; 26: 514-523.
4. Denecke T, Lopez Hänninen E. Brachytherapy of liver metastases. *Recent Results Cancer Res* 2008; 177: 95-104.
5. Galandi D, Antes G. Radiofrequency thermal ablation versus other interventions for hepatocellular carcinoma. *Cochrane Database Syst Rev* 2002; (3): CD003046.
6. Curley SA, Izzo F. Radiofrequency ablation of primary and metastatic hepatic malignancies. *Int J Clin Oncol* 2002; 7: 72-81.
7. Ricke J, Wust P, Wieners G et al. Liver malignancies: CT-guided interstitial brachytherapy in patients with unfavorable lesions for thermal ablation. *J Vasc Interv Radiol* 2004; 15: 1279-1286.
8. Ricke J, Wust P, Stohlmann A et al. CT-guided Interstitial Brachytherapy of Liver Malignancies alone or in combination with Thermal Ablation: Phase I/II Results of a Novel Technique. *Int J Radiat Oncol Biol Phys* 2004; 58: 1496-1505.
9. Dierckx R, Maes A, Peeters M et al. FDG PET for monitoring response to local and locoregional therapy in HCC and liver metastases. *Q J Nucl Med Mol Imag* 2009; 53: 336-342.
10. Rohren EM, Turkington TG, Coleman RE. Clinical applications of PET in oncology. *Radiology* 2004; 231: 305-332.