



Long term results of MR-guided laser induced thermotherapy of colorectal carcinoma metastases in the liver



Martin G. Mack, Katrin Eichler, Ralf Straub, Thomas Lehnert, Thomas J. Vogl

Department of Diagnostic and Interventional Radiology, J.W. Goethe-University, Theodor-Stern-Kai 7, 60590 Frankfurt email: m.mack@em.uni-frankfurt.de Internet: www.litt-therapy.org

Abstract

Background: To evaluate MR-guided LITT for the treatment of colorectal liver metastases in a long-term follow-up study.

Methods: Percutaneous MR-guided LITT was performed under local anesthesia on an outpatient basis with a Nd:YAG laser (1064 nm) in 805 patients (mean age 61.2 years, range 34-84) with 2397 liver metastases of colorectal cancer between 1993 and 2004. 271 patients had recent metastases after surgery, 285 metastases in both liver lobes, 112 refused surgical resection, 30 had general contraindications for surgery and 104 had metastases at difficult localization for surgery. 646 patients were treated with the intention to reach a R0 situation (group 1). These patients had not more than 5 liver metastases and no extrahepatic disease. 159 patients had either extrahepatic disease (lung metastases) or more than 5 metastases in the liver. These patients were treated in palliative intention (group 2). Survival rates were calculated using the Kaplan-Meier method.

Results: The local hepatic tumor control rate at 6-month follow-up was 2.2% for metastases up to 2 cm diameter, 2.9% for metastases between 2 and 3 cm diameter, 0.4% for metastases between 3 and 4 cm diameter and 2.6% for metastases larger than 4 cm in diameter. The mean survival rate for group 1 was 4.0 years (95% confidence interval: 3.7-4.4 years, 1 year survival 95%, 2 year survival 76%, 3 year survival 53%, 5 year survival 27%). The mean survival rate for group 2 was 2.8 years (95% confidence interval: 2.4-3.1 years, 1 year survival 84%, 2 year survival 55%, 3 year survival 28%, 5 year survival 14%). Patients who refused resection and were treated with LITT had a mean survival of 5.5 years, which was statistically significant superior to patients with recurrences after resection, with bilobar metastases and metastases at difficult localization (Tarone Ware p<0.0001, Breslow p=0.0002, Log Rank p<0.0001). Patients with metachronous liver metastases had also superior survival rates compared to patients with synchronous metastases (4.1 years versus 3.5 years (Tarone Ware p=0.0030, Breslow p=0.0062, Log Rank p=0.0049). The initial number of liver metastases and the initial lymph node status were also prognostic factors. The primary tumor stage was not a prognostic factor.

Conclusion: Percutaneous MR-guided LITT yields high local tumor control and very good survival rates in patients with liver metastases of colorectal carcinoma. LITT appears in selected cases superior to resection.

Introduction

Surgical resection is well established in the treatment of liver metastases of colorectal carcinoma, typically yielding 5-year survival rates between 25% and 35%. Two thirds of patients will experience recurrent metastases, and many patients do not benefit from surgery. Data published from studies investigating the efficacy of surgical resection of liver metastases show 1-year survival rates between 71% and 88%; 3-year survival rates between 21% and 46%; and mean survival times between 25 and 35 months. Perioperative mortality ranges from 4.4% to 10%.

The high incidence of new liver metastases following successful resection of metastases – between 60% and 80% – has spurred interest in therapeutic alternatives, the goal of which should be to achieve survival statistics similar to those attained with surgery. Ideally such therapeutic alternatives should be less invasive than liver resection; should have a low complication rate; should be possible under local anesthesia (for patients with general contraindications for surgery) and should be less expensive.

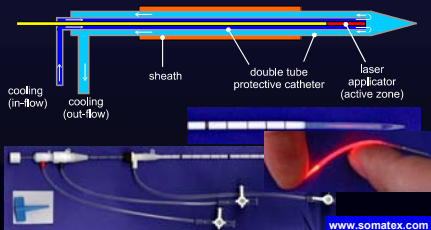
Several studies have proven the effectiveness of local therapies (i.e. PEI and RF, and likely microwaves, and/or ultrasound) for the treatment of primary liver carcinoma. Several studies have indicated that effective local treatment is far more difficult for liver metastases. Radiofrequency ablation has been shown effective in ablation of liver metastases with respect to survival rates, however, a high local recurrence rate between 21.6 and 68.4% has been reported. Besides, several studies have shown that laser-induced interstitial thermotherapy (LITT) is able to destroy not only liver metastases locally resulting in improved survival data

liver metastases of CRC: 06/1993 – 10/2004

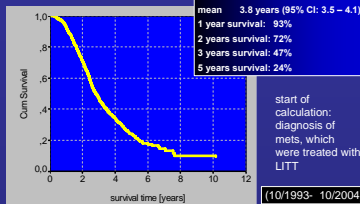
patients	n = 805
mean age	61.2 years (34-84 years)
lesions	total number n = 2,397
	cannulations n = 5,869
	LITT applications n = 10,696
	treatment sessions n = 2,068

Group 1: curative intention (n=646) > 5 liver mets < 5 cm diameter No extrahepatic disease	Group 2: palliative intention (n=159) > 5 liver mets > 5 cm diameter extrahepatic disease (e.g. lung, lymph nodes, bone)
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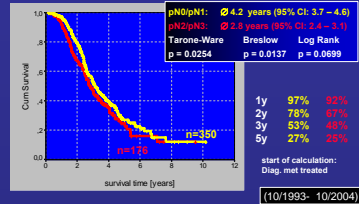
Power laser application system



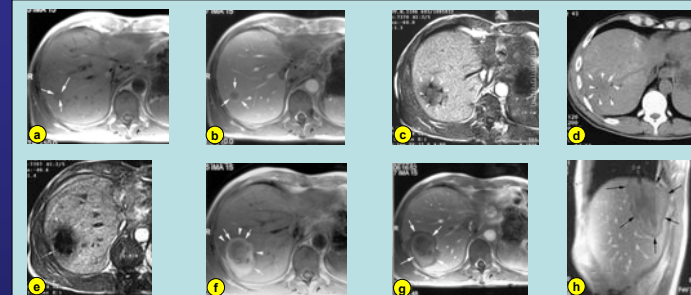
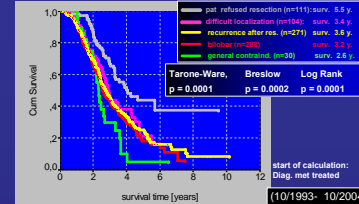
survival colorectal mets: 805 pts, 2397 mets



Lymph node status / curative intention

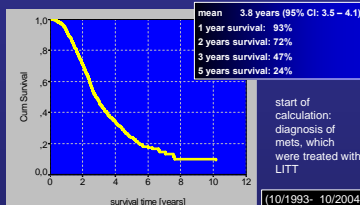


survival colorectal mets: indications



The T1-weighted plain (a) and contrast enhanced (b) image shows a liver metastases in Segment 7/8 (arrows) 3 weeks before LITT treatment. Magnetics markers (arrows) allow an exact visualization of the positioning of the laser application systems on an axial MR image (c) and on a CT image (d). 26 minutes after starting the laser the thermal image (e) shows an obvious signal loss, which is representing a increase of tissue temperature. The T1-weighted plain image (f) 24 hours after the laser ablation is showing the induced coagulation necrosis (arrows). The contrast enhanced images in axial (g) and coronal (h) slice orientation are showing the induced coagulation necrosis 24 hours after the end of the laser treatment. The metastasis and a safety margin was coagulated.

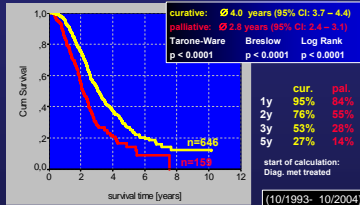
survival colorectal mets: 805 pts, 2397 mets



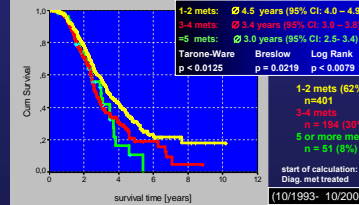
survival colorectal mets: 805 pts, 2397 mets



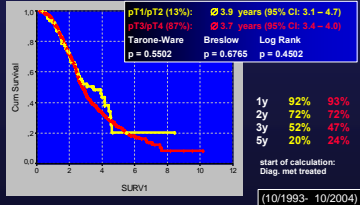
survival colorectal mets: 805 pts, 2397 mets



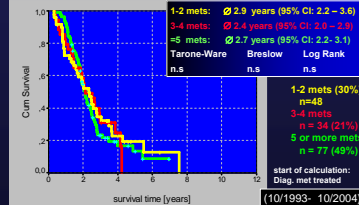
Curative intention: 646 pts, 1883 mets



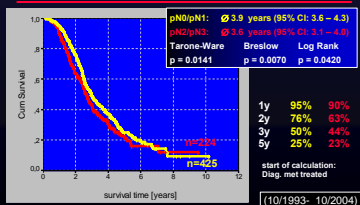
Primary T staging: 805 pts, 2397 mets



palliative intention: 159 pts, 514 mets



Lymph node status



Synchron / metachron: 805 pts, 2397 mets



Conclusion LITT: colorectal liver mets

- LITT of colorectal liver metastases is an alternative to liver resection for patients ablated in curative intention
- Patients fitting the typical inclusion criteria (<=5 mets, diameter <=5 cm, no extrahepatic disease) for ablation perform better than palliative cases
- Prognostic factors are
 - Time between primary tumor and liver metastases
 - Initial lymph node status
 - Number of initial liver metastases
 - Indications for LITT
- Patients treated with palliative intention
 - have benefits from local ablation of liver mets
 - have better survival rates than patients with chemotherapy alone
 - inclusion of these patients has to be an individual decision
 - "inclusion" criteria for these "palliative" patients have to be evaluated and defined further

