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ScienceDirect

EJSO the Journal of Cancer Surgery

EJSO 43 (2017) 181–187

www.ejso.com

# Percutaneous thermal ablation: A new treatment line in the multidisciplinary management of metastatic leiomyosarcoma?

G. Gravel [a,*], S. Yevich [a], L. Tselikas [a], O. Mir [b], C. Teriitehau [a], T. De Baère [a,c], F. Deschamps [a]

[a] *Interventional Radiology Department, Gustave Roussy Cancer Campus Grand Paris, Villejuif, France*
[b] *Department of Cancer Medicine, Gustave Roussy Cancer Campus Grand Paris, Villejuif, France*
[c] *Université Paris-Sud XI, UFR Médecine Le Kremlin-Bicêtre, Le Kremlin Bicêtre, France*

Accepted 8 June 2016
Available online 22 June 2016

**Abstract**

*Background*: The role of percutaneous thermal ablation (PTA) in the multidisciplinary management of metastatic leiomyosarcoma (LMS) has not been thoroughly evaluated.

*Materials and methods*: Single institution retrospective review of all patients with LMS metastases treated with PTA from June 2004 to December 2014. Iterative PTAs were performed as a multifocal treatment for all recurrent or residual macroscopic metastases discovered on imaging after completion of systemic treatment, or alternatively as a targeted treatment of selective metastases found to be progressive on systemic treatment. The primary endpoint was the time to untreatable progression (TTUP), recorded as the time elapsed between the first PTA and the re-initiation of systemic chemotherapy to treat disease progression. Secondary endpoints were overall survival, the 1, 3 and 5-year survival rates, and local control rate.

*Results*: A total of 93 LMS metastases (average diameter 18.2 mm, range 3–45 mm) were successfully treated in 30 patients over 50 treatment sessions with a median follow-up of 34.6 months. The median TTUP was 14.2 months (range 2.4–122.8). The median overall survival after PTA was 48.3 months and the 1, 3 and 5-year overall survival rates were 96.7% (95%CI 84.3–100.0%), 62.0% (95%CI 45.8–84.0%), and 28.3% (95%CI 13.5–59.1%) respectively. Local control rate at 1 year was 95.2% and at 3 years was 89.4%.

*Conclusion*: Iterative PTA is an effective treatment line option for appropriately selected patients with metastatic LMS that can delay re-initiation of systemic chemotherapy.



*Keywords:* Leiomyosarcoma; Metastases; Percutaneous; Ablation

## Introduction

Leiomyosarcoma (LMS) is one of the most frequent subtypes of soft-tissue sarcomas (STS), with an incidence of approximately 1 per 100,000[1,2] and a mean age at diagnosis around 60 years of age.[3] The five-year relative survival rate is reported as 49% and correlates to the primary site, which is commonly located in the extremities, abdomen, or retroperitoneum.[1,4,5] Approximately 40% of patients will experience metastases. The most frequent metastatic locations are found in the lung, followed by the liver and soft tissues.[4]

The recommended treatment of recurrent or metastatic LMS differs based on location and extent of metastases. Surgical resection is recommended for metachronous lung metastasis without extrapulmonary disease.[6] For patients with extrapulmonary metastatic disease, however, the treatment recommendations predominantly focus on anthracycline-based chemotherapy regimens,[6,7] which have suboptimal results with a median overall survival of approximately 12 months.[8,9] Recently, the use of targeted local therapies for oligometastatic and oligorecurrent disease has contributed to a paradigm shift in treatment of different types of metastatic

* Corresponding author. Tel.: +33 6 50 55 20 64.
*E-mail address:* guillaumegravel@gmail.com (G. Gravel).

http://dx.doi.org/10.1016/j.ejso.2016.06.391

cancer.[10] Indeed, the use of local therapies to treat pulmonary and extrapulmonary sarcoma metastases show prolongation of overall survival[11] and may secondarily delay chemotherapy re-initiation for progressive disease.

Percutaneous thermal ablation (PTA), which encompasses radiofrequency ablation, microwave ablation, and cryoablation, is a local treatment that is gaining widespread recognition as a well-tolerated curative local therapy for primary and metastatic lesions in the liver, lung and bones that measure less than 3 cm in diameter.[12–16] All PTA techniques are minimally invasive treatments that rely on precise image-guided placement of therapeutic needles into the target lesion and subsequent focal application of either extreme heat or cold to cause local tissue necrosis. PTA as a local therapy for sarcomatous metastases has been demonstrated to provide effective local control and positive impact on overall survival,[11,17–19] although no study has evaluated the potential role of PTA specifically for metastatic leiomyosarcomas.

The aim of this study is to evaluate the clinical outcomes of multifocal and re-iterative PTA as a treatment line approach for both pulmonary and extrapulmonary LMS metastases.

## Materials and methods

### *Data collection*

We retrospectively review the treatment and outcomes of PTA for patients with pulmonary and extrapulmonary LMS metastases performed in our single institution cancer center from June 2004 to December 2014. Board review approval was waived in accordance with our institution's policy on chart reviews. Patient records were reviewed for patient demographics, primary disease site and tumor grade, history of prior treatments, type of PTA performed, number and size of metastases ablated, site of ablation, local recurrence at ablation site, indication and timing of chemotherapy re-initiation, and overall survival data.

### *Groups*

Thermal ablation indications were discussed at multidisciplinary meetings and patients were selected for PTA treatment if disease met one of the three following group criteria. Group 1 consisted of patients with metastatic recurrence that appeared after the completion of systemic treatment, for which PTA was chosen to eradicate all recurrent macroscopic new disease. Group 2 consisted of patients with residual metastases that demonstrated incomplete response after systemic treatment, for which PTA was chosen for complete eradication of the persistent metastatic disease. Group 3 consisted of patients with high tumor burden, for which PTA was chosen to selectively eradicate metastases that demonstrated progression on systemic chemotherapy.

### *Procedures*

All PTA procedures were performed under image guidance using CT, ultrasound, or fluoroscopy by an interventional radiologist with greater than 5 years of experience in PTA techniques (T.d.B., F.D., L.T., S.Y., C.T.). Procedures were performed either under conscious sedation or general anesthesia depending on ablation modality and anticipated discomfort for the patient during the procedure. The selection of the ablation modality, needle type, and time to treat were based on tumor size, location, and adjacent anatomic structures. PTA was performed either by radiofrequency ablation using a straight electrode needle (Cool-Tip®, Covidien, Boulder, Colorado, USA) or deployable electrode needle (Boston scientific, Marlborough, Massachusetts, USA) (Fig. 1), by cryoablation (Icesphere®, Galil medical, Yokneam, Israel) (Fig. 2), or by microwave ablation (Amica, HS medical, Rome, Italy). Informed patient consent was obtained prior to every procedure.

### *Endpoints*

The primary endpoint of our study was the time to untreatable progression (TTUP), defined by Bruix et al.[20] as a disease progression profile that has surpassed the threshold for which a local treatment could induce an objective response. When TTUP was reached, local treatment would be considered unavailing and the patient would proceed with systemic chemotherapy. TTUP was thus recorded as the time elapsed between first ablation treatment and the reinitiation of systemic chemotherapy. The secondary endpoints were recorded as the overall survival, the 1-year, 3-year and 5-year overall survival rates, and the local control rate.

### *Statistical analysis*

Statistical analysis was performed using Web statistics tool BiostaTGV. TTUP and overall survival were generated according to the Kaplan–Meier method, and log ranking was used to compare groups. A p value of $<0.05$ was considered significant.

## Results

### *Patients*

Of the 33 consecutive patients treated with PTA for metastatic LMS in our institution, a total of 30 patients (13:17 M:F, age range 31–80 years) were included in this retrospective study. Three patients were excluded due to absence of follow up (1 patient) or because treatment was not performed to impact survival but rather for palliative tumor debulking and pain control (2 patients). All patients underwent primary tumor resection and in addition ten