VIA MEDICA

ORIGINAL ARTICLE

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Microwave ablation of colorectal cancer lung metastases — the first experience in Poland

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Oncology in Clinical Practice
DOI: 10.5603/ OCP.2022.0008

ISSN 2450–1654
e-ISSN 2450–6478

ABSTRACT

Introduction. This study aimed to present the results of the first experiences in thermal ablation of colorectal cancer lung metastases in Poland.

Material and methods. Seven patients with colorectal cancer lung metastases were treated with CT-guided microwave ablation. One of them was lost to follow-up, so 6 patients with 7 metastatic foci were included in this study. The mean diameter of lesions was 15 mm (10–20 mm). The patients were disqualified from surgical treatment due to comorbidities.

Results. The mean duration of follow-up was 15 months (range: 6–29). No mortality was noted during that period. Local progression was not reported, while distant progression was found in two patients. Two patients presented with pneumothorax just after the ablation, and one of them required chest tube drainage. No complications were noted.

Conclusions. Patients with a few small colorectal cancer lung metastases can benefit from thermal ablation. The method is safe and should be available for medically inoperable patients with pulmonary oligometastatic disease.

Key words: colorectal cancer, lung metastases, interventional radiology, locoregional treatment, microwave ablation, lung ablation

Introduction

Colorectal cancer is the third most commonly diagnosed malignancy and the second most common cause of cancer death [1]. The lung is the second (after liver) site of metastases for this malignancy with an incidence of around 10% [2]. For many years, patients with colorectal cancer and lung metastases have been considered to be in the end-stage of disease and were treated using only palliative therapy. In the 1990s, a concept of oligometastatic disease was presented [3]. It assumed potentially better survival rates if all foci of the disease would be removed in patients with a limited number of secondary deposits [4–6].

Resection is an established method of treatment of patients with colorectal cancer and pulmonary metastases [7], but there is a group of patients who are ineligible for surgery due to their comorbidities or limited pulmonary function. For these patients, stereotactic body radiotherapy is an optional treatment method; however, it has higher rates of local progression than the treatment of metastases from other sources [8].

Percutaneous computed tomography-guided thermal ablation has been used in the treatment of lung tumors since 1999 [9]. Since then it established its role in the treatment of patients with colorectal cancer lung metastases and is present in the international oncology guidelines [7, 10]. There is extensive evidence on

Received: 09.12.2021 Accepted: 10.12.2021 Early publication date: 07.03.2022

lung ablation efficacy [11], which is comparable with resection in terms of small (< 2 cm) lung metastases treatment.

Unfortunately, lung ablation is not widely available for patients in Poland due to the lack of reimbursement by the National Health Fund. The first attempts of performing this procedure started in academic and private healthcare in 2019. The purpose of this study is to present the results of the first experiences in thermal ablation of colorectal cancer lung metastases in Poland.

Material and methods

The Institutional Review Board waived the need for its formal consent due to the retrospective nature of this study. Seven patients with colorectal cancer lung metastases were treated with microwave ablation. One of them was lost to follow-up, and 6 patients with 7 metastatic foci were included in this study. One patient had single metastases in both lungs which were ablated in two separate procedures, 3 weeks apart. The remaining 5 patients had single metastases in one lung. There were 4 females and 2 males among the patients included in the study. The mean age of the patients was 56 years (50–79). The mean diameter of lesions was 15 mm (10–20 mm). Two patients had also single liver metastases that were treated during the same procedures. No extra-pulmonary metastases were visible in other patients. The patients were disqualified from surgical treatment due to comorbidities. Two patients had undergone lung surgery but were not fit for repeated resection.

The ablations were done with one of two microwave systems (Emprint, Medtronic, Minneapolis, MN, USA and Solero, Angiodynamics, Latham, NY, USA). All procedures were performed under general anesthesia with computed tomography (CT)-guidance (320-row CT scanner, Toshiba Aquilion One, Toshiba/Canon, Nasu, Japan). Contrast-enhanced CT was done immediately after each procedure to confirm the size of the ablation zone and to assess for possible complications. Chest x-ray was done 4–6 hours after ablation. The procedures were performed by three interventional radiologists with experience in CT-guided ablations. The follow-up protocol applied included CT exams at 6 weeks after ablation and, then, repeated every 3 months for at least 2 years.

Results

The mean duration of the follow-up was 15 months (range: 6–29). No mortality was noted during that period (Tab. 1). Local progression was not reported, while distant progression was found in two patients. Two patients presented with pneumothorax just after the ablation, and one of them required chest tube drainage. No complications were noted. No statistical analysis was performed due to the small number of patients included in the study.

Discussion

Thermal ablation of colorectal cancer lung metastases is an established method of treatment, especially in medically inoperable patients. This minimally invasive procedure is included in major oncological guidelines e.g. ESMO and NCCN [7, 10] as a method of management of such patients.

Local Tumor Progression

None of the patients in our study presented with local tumor progression. The results are in concordance with other publications. Kurilova et al. [12] reported local tumor progression-free survival rates of 93% (after 1 year) and 86% (after 3 years) while overall survival rates were 94% and 82%, respectively.

A prospective multicenter study by Hasegawa et al. [13] reported 3-year overall survival of 84% of participants and local progression-free survival of 91%. This

Table 1. The results of microwave ablation of colorectal cancer lung metastases

Patient	Age	Tumor diameter	Lung segment	Follow-up (months)	Local progression	Distant progression
1	60	19	6L	8	0	1
2	60	12	6R	27	0	
2		13	3L	26	0	
3	79	16	4L	9	0	
4	78	20	8R	15	0	
5	50	16	4R	29	0	1
6	70	10	6L	6	0	

study included patients who underwent thermal ablation of colorectal cancer lung metastases with lesions measuring ≤ 3 cm in diameter. The results of the study are similar to publications on surgical resection reporting 3-year OS in the range of 71–82% [14, 15].

New metastases

Two patients in our study presented with new metastases in the lungs; however, they were ineligible for repeat ablation due to a large number of new lesions. Such disseminated progression is probably associated with more aggressive tumor biology because no local tumor progression was seen in these patients.

Tumor recurrence can be expected in over 50% of patients after pulmonary metastasectomy [16]. Repeat resection can be a valid option in some patients, but in many cases, it is not feasible, e.g. due to expected loss of pulmonary volume and function.

Lung preserving treatment is highly desirable in such patients. Unlike surgery [17] or radiotherapy [18], thermal ablation has no negative impact on pulmonary function [19].

The ability to repeat ablation in case of relapse is an important advantage of this method, as is the possibility of rapid assessment of treatment results (after 1 month). If a local relapse is reported, the lesion can be quickly re-ablated.

Complications

Pneumothorax occurred after 2 procedures; however, similarly to surgery, it should not be regarded as a complication but rather as an expected outcome of the procedure [20]. Having this in mind no major complications were noted. Low incidence of complications without any mortality is expected in CT-guided ablation of lung tumors [12].

Oligometastatic disease

Local treatment methods can be applied in the setting of oligometastatic disease, which is typically defined as the presence of 1–5 metastases in 1–2 organs. This concept is based on better survival rates of such patients if all metastases are resected or ablated [4, 5].

Metastasectomy is an effective method of colorectal lung metastases management [21] even though no randomized controlled trial is available to support data from other trials [22].

Still, only selected patients can undergo resection of colorectal lung metastases while repeat surgery is restricted to an even more exclusive group. For medically inoperable patients, ablation and radiotherapy are options of treatment.

Stereotactic body radiotherapy (SBRT) is one of the most frequently applied methods of treatment in medically inoperable patients. The efficacy of SBRT in terms of 3-year OS was reported by Agolli [23], Wegner et al. [24], and Yamamoto et al. [25] at 50.8%, 58%, 63.4% respectively. Relatively lower efficacy of SBRT in these studies is probably associated with radioresistance of colorectal cancer metastases compared to secondary deposits from other tumors — local progression rates are in the range of 42% *vs.* 16% [8]. According to the National Comprehensive Cancer Network (NCCN) guidelines, radiotherapy can be used in the treatment of such patients, however, its role is limited: "Conformal external beam radiation therapy may be considered in highly selected cases or the setting of a clinical trial and should not be used indiscriminately in patients who are potentially surgically resectable."

Still, SBRT is the only locoregional therapeutic option offered in Poland to medically inoperable patients with oligometastatic pulmonary disease in the setting of colorectal cancer.

Excellent results of many studies including the recent one by Hasegawa et al. [13], with 84% 3-year survival, support the need for wide access to thermal ablation for patients with colorectal lung metastases. This approach is supported by NCCN Colorectal Cancer guidelines v 2.2021: "Ablative techniques may be considered alone or in conjunction with resection for resectable disease. All original sites of the disease need to be amenable to ablation or resection. Ablative techniques can also be considered when unresectable and amenable to complete ablation."

Limitations

The most important limitation of the study is the small number of patients. A relatively short follow-up period can also be a source of potential bias. The lack of data on the systemic treatment of these patients is also a limitation of this study.

Conclusions

The results of the study as well as other publications including current guidelines show that patients with a few small colorectal cancer lung metastases can benefit from thermal ablation. The method is safe and should be available for medically inoperable patients with pulmonary oligometastatic disease.

Conflict of interest

Authors declare no conflict of interest.

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