



Review

Interventional radiology: Role in the treatment of sarcomas



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Abstract In bone and soft tissue sarcomas (STS), surgery was to the only local curative treatment, but recently, radiation therapy and interventional radiology has evolved to potentially curative treatment, namely in small size tumours. Indication for local treatment in STS needs validation in multidisciplinary team. Most will agree on local treatment for single metastatic location in a well-controlled disease and for no local treatment in a rapidly evolving multi-metastatic disease. The challenge is in patients who are in between, for whom benefit of disease control on overall survival should be evaluated. Local treatment has been reported beneficial in some large retrospective series, regardless of the association with chemotherapy in selected patients with oligometastatic disease.

Recent technical innovation in image guidance allows to deliver local treatment through needles inserted percutaneously, and image-guided thermal ablation of small tumour is now part of the treatment armamentarium in selected oligometastatic diseases, allowing for local destruction of small tumour. Radiofrequency ablation allows to control small size STS lung metastases in roughly 90% of attempts, thus providing an efficient and low-invasive local control with preservation of organ function. Small size bone deposit can be targeted with the same rate of efficacy when tumours are small. Ablation can be used in the liver when some tumour foci become resistant to systemic therapy, namely in gastrointestinal stromal tumour patients. In addition, interventional radiology can now provide efficient and rapid pain palliation as well as bone reconstruction with the use of cementoplasty and percutaneous osteosynthesis, alongside radiation therapy which has been a long time player for pain palliation in bone metastases.

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1. Introduction

Interventional radiology plays an important role in the diagnosis of sarcomas with image-guided percutaneous core needle biopsy being the most commonly used biopsy technique in the diagnosis of these mesenchymal neoplasms. Such biopsy is performed in routine clinical practice for the diagnosis of the initial primary tumour [1,2] and is sometimes required to confirm distant relapses or local recurrence in front of suspicious image finding. Owing to technical innovation in catheters, needles and biomaterials, associated with improvement of medical imaging, including real-time 3D imaging, interventional radiology is now part of the treatment armamentarium in selected oligometastatic diseases in many cancer types, allowing for local or locoregional treatment of cancer or cancer-related symptoms. This article will review the role of interventional oncology in bone and soft tissue sarcomas (STS), beyond this diagnostic role, and possible future developments.

STS covers a large scope of tumour with more than 100 different histologic subtypes of heterogeneous origins and very different natural outcomes [2]. Consequently, the approach to metastatic STS may vary a lot according to the patient's characteristics, histological subtypes of the primary tumour, the extent of the disease, including the site, size and number of metastases, the interval between the primary tumour and first metastatic relapse, the interval between two metastatic events and patient comorbidities. A common pattern of most sarcomas concerns the suboptimal results of systemic chemotherapy; consequently, a large place is left to local treatment both for primary and metastatic tumour. Local treatments find a role mostly when the disease is still limited, especially if confined to a single organ or oligometastatic; oligometastatic diseases are characterised in most publication by a maximum number of five metastatic lesions and the localisation of the disease to two or occasionally three sites.

During the last decades, surgery combined with or not with radiation therapy was the only curative approach in oligometastatic diseases. In the recent years, radiation therapy has evolved to potentially curative treatments namely with stereotactic body radiation therapy, and percutaneous ablation techniques have demonstrated a high potential for complete destruction of small size tumours. In addition, interventional radiology can now provide efficient and rapid pain palliation as well as bone reconstruction with the use of cementoplasty and percutaneous osteosynthesis, alongside radiation therapy which has been a long time player for pain palliation in bone metastases.

The role of interventional radiology treatment will be discussed in the following paragraph with an extensive overview of publication on lung metastases, which in

sarcomas are the predominating site of metastases and the exclusive site in over 50% of cases.

2. Rationale for local therapy

In patients affected by oligometastatic disease, complete surgical resection of all metastatic sites is in fact considered the primary treatment because complete remission is critical for cure [1,2]. However, there is no randomised study to demonstrate the benefit of complete remission on prolonged survival, and this longer survival can be attributed to patient selection that will have survived longer than the overall population even if not locally treated. Many published data addressing osteosarcomas [3], angiosarcomas [4] and synovial sarcomas [5] advocate for complete eradication of metastases as beneficial. Consequently, the decision-making to use local therapies is complex, depends on diverse presentations and histologies and should always be taken in a multidisciplinary discussion.

Some arguments for using local treatments come from retrospective analysis such as a study where among 281 oligometastatic sarcoma patients (1–5 metastases), 164 patients received local treatment, including surgery (77.9%) and radiofrequency ablation (RFA; 16.4%) [6]. Patients suffered from lung (71.5%), hepatic (10.6%) and extrapulmonary and extrahepatic metastases (19.2%) at the onset of the oligometastatic diseases. The extrapulmonary and hepatic sites were bones (3.2%), soft tissues (4.6%), subcutaneous tissues (3.6%), lymph nodes (7.1%), cerebral tissues (1.8%) and peritoneal (4.3%) tissues. Local treatments were repeated once, twice or thrice, four or five times and more than six times in 43.6%, 28.7%, 2.8% and 0.7% of patients, respectively. Although the duration of remission decreased with the cumulative number of oligometastatic events, most patients who were able to receive more than four treatments seemed to benefit from it. Overall, the 2-year overall survival (OS) rates were 52.4 (95% confidence interval [CI] = 45.3–59.1) for the whole population, 36.3% (95% CI = 25.9–46.7) for the non-local treatment group and 63.6% (95% CI = 54.2–71.6) for the locally treated group (hazard ratio [HR] = 0.4; 95% CI = 0.29–0.57; $P < 0.0001$). Analysis using propensity score built with number of oligometastatic events before inclusion; controlled or non-controlled primary tumour; primary tumour size; quality of the resection of the primary tumour (R0, R1, R2 or not operated) and site of metastasis (lung only, liver only, other) did not change the conclusion with an adjusted HR = 0.47 (95% CI = 0.29–0.78; $P < 0.001$). Moreover, local treatment was beneficial regardless of the association with chemotherapy, with an HR = 0.54 for local treatment (95% CI = 0.23–1.45, $P = 0.146$). This

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