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Whole-body magnetic resonance imaging in myxoid liposarcoma: A useful adjunct for the detection of extra-pulmonary metastatic disease

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Abstract

Myxoid liposarcomas (MLS) are a subgroup of soft-tissue sarcomas which have a propensity for extra-pulmonary metastases. Conventional radiological staging of soft-tissue sarcomas consists of chest radiographs (CXR) and thoracic computed tomography (CT) for possible chest metastases, supplemented by magnetic resonance imaging (MRI) for local disease. The optimal radiological modality to detect extra-pulmonary metastases for systemic staging has not been proven. We reviewed the efficacy of Whole-Body MRI (WBMRI) for this purpose.

33 WBMRI and simultaneous CT scans were performed in 28 patients suffering from MLS between 2007 and 2015. 38 metastases were identified in seven patients via WBMRI. Osseous lesions predominated (spine, pelvis, chest-wall and long bones), followed by soft-tissue and abdominal lesions. Of the 29 soft-tissue or osseous metastases that were within the field-of-view of the simultaneous CT scans, five soft-tissue and zero osseous metastases were identified using CT. Metastatic disease was detected in three patients solely using WBMRI, which directly influenced their management.

WBMRI is a useful adjunct in the detection of extra-pulmonary metastatic disease, which directly alters patient management. WBMRI has demonstrated an ability to identify more sites of metastatic disease compared to CT. WBMRI should be used in two situations. Firstly, at diagnosis where ablative treatment will be required e.g. amputation, when the diagnosis of occult metastasis would change treatment planning. Secondly, at diagnosis of relapse to confirm if it is a solitary site of relapse prior to consideration of metastectomy.

Keywords: Myxoid liposarcoma; Sarcoma; Metastasis; Neoplasm staging; MRI

Introduction

Soft-tissue sarcomas are a heterogeneous group of uncommon tumours arising from mesenchymal cells at all body sites. These rare tumours comprise approximately 1% of all newly diagnosed cancers. Liposarcomas account for 10% of all soft-tissue sarcomas and myxoid liposarcomas (MLS) are the second most common histological subtype.[1] This distinct form of liposarcoma contains the fusion of the TLS-CHOP transcript and typically arises in the 4th and 5th decades.[2]

MLS is histologically characterised by uniform round to oval shaped primitive non-lipogenic mesenchymal cells and a variable number of small signet-ring lipoblasts in a prominent myxoid stroma with a characteristic branching

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vascular pattern.[2] The World Health Organisation describe a subset of MLS showing histological progression to hypercellular or round cell (RC) morphology, which is associated with a poorer prognosis.[2] The incidence of MLS local recurrence is reported to range from 9%[3]–18%[4] and one-third of all MLS patients develop distant metastatic spread. When the RC content of the primary tumours is greater than 5% the likelihood of metastasis and worse prognosis is greater.[5] The survival for non-RC MLS is reported to be 91% at ten years compared to 52% if RC is less than 5% and 31% when RC is greater than 5%.[6] Independent adverse prognostic factors for metastases in liposarcoma include old age and large tumour size.[1]

In contrast to other liposarcoma subtypes which metastasise to the lung, MLS metastases have a propensity to occur in extra-pulmonary skeletal and soft-tissue sites which may range from appendicular muscular lesions to retroperitoneal, pericardial, chest wall or spinal lesions.[4,7,8] A significant number of MLS patients present with synchronous or metachronous metastases.[2,5] The incidence of metastases for MLS (for all RC components) ranges from 10%[1]–32.5%[6] of which the proportion of extra-pulmonary metastases ranges from 73%[3,6]–100%.[4] Therefore routine chest radiographs are limited in their ability to identify the majority of metastases in MLS and alternative methods to screen for relapse have been scrutinised in a number of studies. MLS is more chemo- and radiosensitive than other liposarcoma sub-groups, therefore early detection of MLS metastases may influence management and improve outcomes.[9,10] Imaging protocols to screen for metastases, based upon expert opinion, are varied due to a lack of prospective studies.[11–13]

Multiple imaging modalities are utilised in the diagnosis, staging and screening for relapse in soft-tissue sarcomas. Chest radiographs (CXRs) and chest computed tomography (CT) are advocated for routine radiological surveillance for pulmonary metastases that may develop typically within the first three years after excision.[14] The use of chest CT over CXRs has yet to be shown to be beneficial or cost effective for this purpose.[15] Detection of MLS metastases remains challenging as radiographs, CT, positron emission tomography (PET) and bone scintigraphy all have limitations.[4,16,17] Magnetic Resonance Imaging (MRI) depicts marrow pathology with high resolution and excellent soft-tissue contrast. Regional MRI, although sensitive to MLS bone and soft-tissue metastases,[18] is of limited use due to the extensive range of anatomical locations MLS metastases may develop.

WBMRI first became practical with the introduction of multi-channel MR scanners. These scanners use a system of multiple phased array coils that cover the body like a matrix and free table movement with parallel imaging acquisition techniques.[19] These permit integrated imaging of the whole body without spatial resolution compromise or lengthy acquisition times. The purpose of this study was to review the utility of WBMRI in detecting metastatic MLS lesions.

Methods

Patients with a histological diagnosis of MLS were retrospectively identified from the databases of a supraregional sarcoma multidisciplinary team (MDT). The search was augmented by interrogating the PACS servers for requests for whole body MRI scans. Twenty eight patients with a diagnosis of MLS underwent WBMRI between 2007 and 2015. Not all patients with a diagnosis of MLS during this time underwent WBMRI. There were a minimum of 23 patients diagnosed with MLS during this time who did not receive a WBMRI scan. WBMRI scans were used selectively as the experience with the technique was developed. There were two main indications for WBMRI initially; at diagnosis as part of initial distal staging, when then presenting lesion was superficial, to identify if there was a deep occult primary tumour or if there was a large primary tumour and the risk of distant metastasis was felt to be high. Secondly, WBMRI was performed when there was a suspicion or diagnosis of relapse as part of distal staging.

Routine initial staging included regional MRI, ultrasound guided biopsies and a chest CT scan. WBMRI scans were performed at the time of initial diagnosis for two indications. Evaluation of suspected metastasis was determined from histological and radiological characteristics and discussed in the MDT meeting.

The routine post-surgical screening for pulmonary metastases was in line with international guidelines[15] and other tertiary centers. This included clinical examination and CXRs every three months for the first two years, and chest CT if there were concerns on the initial staging CT scan. Assessment continued with six monthly clinical and radiological review until five years post-operatively, followed by annual follow-up.[20]

WBMRI scans were performed on a 1.5 T system (Siemens 18 channel Magnetom Avanto with body suite, Erlangen, Germany) using multiple phased-array coils. T1-weighted spin-echo (SE) images (638/11 [repetition time ms/echo time ms], 5 mm slice thickness and a 307 × 384 matrix) and T2 weighted STIR (short tau inversion recovery) sequences (9860/91 [repetition time ms/echo time ms], 5 mm slice thickness and a 269 × 384 matrix) were performed in coronal and transverse planes covering the whole body from the top of the head to the tip of the toes using 6–7 stations. An additional transverse STIR set was performed through any high signal lesion noted on the coronal STIR images. Images were reformatted and reviewed using GE PACS (Picture Archiving and Communication System) on high resolution monitors. Scans lasted approximately 60 min and all WBMRI scans were tolerated by patients. Interpreting scans required on average 30 min of reporting time.

Statistical analysis was performed using R and Deducer statistical software packages and results were