Chest CT findings at presentation in patients with soft tissue sarcomas

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Purpose

Soft-tissue sarcomas account for less than 1% of all malignancies, but they represent a high percentage of cancer-related deaths worldwide. Accurate pre-treatment evaluation is important for treating soft-tissue sarcomas, often establishing whether or not pre-operative adjuvant therapy is required.

Managing patients with soft tissue sarcoma (STS) requires staging to determine local, nodal and distant disease status to determine whether pre-operative adjuvant therapy is needed, particularly if lung metastases are present. Fifty percent of high grade tumor develop metastases despite adequate treatment. Less than 10% of those with metastases survive less than 2 years (figure 1)[1].

Regardless of histological type, most patients who develop or present with distant metastases present with lung metastases (regardless of STS type)[2]. The most recent comprehensive review by Billingsley et al. (1999) identified 3149 adult patients with a diagnosis of sarcoma between July 1982 and Feb 1997, with 719 (22%) developing or presenting with lung metastases. Initial metastases to other sites such as the liver, brain, and soft tissue distant from the primary tumour are rare.

Long-term survival is possible in selected patients, particularly when recurrent pulmonary disease is resected. Surgical excision should remain the treatment of choice for metastases of soft tissue sarcoma to the lung.[3]

Recent literature suggests patients with a suspected soft tissue sarcoma should undergo a chest radiograph at presentation, prior to histological diagnosis, and proceed to CT chest if i) an abnormality on CxR is identified ii) patients have a large, deep positioned or high/intermediate grade tumour, or iii) for patients with certain histological subtypes where the incidence of lung metastases at diagnosis is known to be high. At our institution, CT chest is routine in the staging for patients with suspected soft tissue sarcoma. This study intends to compare the findings on CT chest to previous literature with regards to incidence of lung metastases.
Fig. 1: Descriptions of Stages, Grades, and the Tumor-Node-Metastasis (TNM) System of the American Joint Committee on Cancer for Soft-Tissue Sarcoma and the International Union against Cancer.

Methods and Materials

A single institution retrospective review was performed with all patients with a pathology diagnosis of a sarcoma from CT-guided biopsy and surgically confirmed between 2008 and 2011, and undertaking CT chest imaging within the same institution at time of biopsy.

Patient demographics, tumour type and presence of lung metastatic disease at presentation were obtained.

- retrospective search by radiology database of all CT-guided soft tissue and bone biopsies January 2008 to December 2011
- pathology reviewed in Soft Tissue Sarcoma weekly multidisciplinary meeting (in conjunction with radiology findings +/- CT chest imaging if available)
- CT chest imaging performed within 30 days of biopsy at institution (ie external imaging excluded)

CT findings were placed into one of 3 categories:

- Category 1: no nodules
- Category 2: nodule(s) indeterminate or non-specific
- Category 3: lesions suspicious for metastasis
Results

Number of patients with pathological diagnosis of sarcoma: 243 (136 males, 107 females)

Average age at time of biopsy: 53.60 years

Number of biopsies: 251 (3 patients with two biopsies, 3 patients with 3 biopsies)

Refer to Tables 1-4 for results summaries, with the key findings listed in Table 3.

128 CT chest scans in 125 patients within 30 days of biopsy (Table 3):
- mean age 54.1 years, 74 males: 50 females
- 9 had CT chest performed on same day
- 97 within 7 days prior to biopsy (5 within 7-30 days prior)
- 8 performed within the 7 days after biopsy (8 with 7-30 days after)

Category 1 (no nodules) for 79 scans (62.7%)
Category 2 (indeterminate or non-specific nodules) in 35 (27.8%)
Category 3 (nodules or lesions suspicious for metastasis) in 12 (9.5%)

Ten (10) of 23 scans for patients with high grade pleomorphic sarcoma had indeterminate or suspicious lung lesions on CT chest at time of biopsy

Six (6) of 19 scans for patients with malignant fibrous histiocytoma (MFH) had indeterminate or suspicious lung lesions on CT chest at time of biopsy

Seven (7) of 14 scans for patients with osteosarcoma had indeterminate or suspicious lung lesions on CT chest at time of biopsy

- one or less scans with suspicious lung findings within each of the remaining sarcoma classifications described (including Ewing's, angiosarcoma and leiomyosarcoma)

Table 4 highlights patients with a pathology diagnosis of sarcoma from biopsy but no CT chest within 30 days of biopsy:
i) 57 biopsies (55 patients): no CT scan record available to correlate with biopsy (likely imaging performed externally prior to referral for biopsy)

ii) 66 biopsies: scan performed >30 days from biopsy (10 prior to biopsy, 56 after biopsy)

Two cases are provided for further illustration of the results findings:

In case 1 (figure 2), CT chest staging performed in an 84 year old female with tibial pleomorphic sarcoma identified a right lower lobe subpleural indeterminate nodule. Three months following surgery for tumour excision, she presentation with acute dyspnoea with repeat CT displaying progression of previous nodule to malignant effusion and development of contralateral pulmonary nodules. This was subsequently treated with thoracotomy and talc pleurodesis.

In case 2 (figure 3), CT chest staging performed in a 19 year old with tibial osteosarcoma identified bilateral numerous pulmonary nodules.

This patient underwent initial chemotherapy, with subsequent reduction of size of nodules at 3 months following adjuvant therapy prior to tibial tumour surgical excision.
Fig. 1: Descriptions of Stages, Grades, and the Tumor-Node-Metastasis (TNM) System of the American Joint Committee on Cancer for Soft-Tissue Sarcoma and the International Union against Cancer.

**Table 1:** Sarcoma types by biopsy site (2008-2011): 251 CT-guided biopsy procedures performed with subsequent histology of sarcoma.

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Table 2: Sarcoma types by histological classification (243 patients undergoing 251 CT-guided biopsy procedures 2008-2011)

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Table 3: Categorisation of CT chest findings (for scans performed within 30 days of biopsy). Category 1: no nodules identified. Category 2: nodules identified but not considered to be conclusively metastatic. Category 2: nodules considered to be likely to be metastatic.

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Table 4: Listing of biopsies with no concurrent CT chest at biopsy institution at time of biopsy, and categorisation of CT chest findings for other biopsies performed but CT chest performed at >30 days from time of biopsy. Category 1: no nodules identified. Category 2: nodules identified but not considered to be conclusively metastatic. Category 2: nodules considered to be likely to be metastatic.

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Fig. 2: Case example 1. 84 year old female with diagnosis of tibial pleomorphic sarcoma and staging CT chest with an indeterminate right lower lobe subpleural subcentimetre nodule. She re-presented 3/12 post surgical tumour excision with dyspnoea, with repeat CT imaging identifying intrathoracic disease progression and undergoing subsequent thoracotomy and talc pleuradesis.

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Fig. 3: Case example 2. 19 year old male with diagnosis of tibia osteosarcoma and multiple pulmonary nodules on staging CT chest. Subsequent CT chest following 3/12 chemotherapy shows reduced size of nodules.

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Conclusion

This study highlights the high proportion of metastases present at the time of diagnosis in patients with pathologically-proven sarcoma.

In this retrospective review, potentially 37.3% of initial staging scans performed for patients with sarcoma had metastases (indeterminate nodules 27.8% + suspicious 9.5%). This rate is higher than that quoted by previous literature of up to 22% (Billingsley et al., 1999). This may reflect higher tumour grades at this institution or better detection of smaller lesions with CT. However, it should be noted this study only highlights findings on initial CT staging and does not assess whether patients with indeterminate findings subsequently develop metastases.

This study also highlighted that while most CT staging studies are performed in an appropriate timeframe (128 of 243 within 30 days of biopsy), ~23% of scans are performed greater than 30 days from biopsy, which potentially may delay decision-making on adjuvant and/or surgical treatment planning.

The results of this study confirms and underline the use of routine pre-surgical CT chest imaging as crucial to the accurate pre-operative staging assessment for patients with sarcoma.
Personal Information

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Xavier's supervisors, Dr Marcus Pianta (Radiologist) and Associate Professor Stephen Schlicht (Director of Medical Imaging), are part of the Cancer Services Sarcoma multidisciplinary team at St Vincent's Hospital.
References


