ABCs of SOFT TISSUE SARCOMA IMAGING

1st Singapore Sarcoma Consortium Education & Research Meeting 2013

STEVEN WONG BAK SIEW

DEPARTMENT OF DIAGNOSTIC RADIOLOGY

2nd March 2013
I HAVE NO DISCLOSURE OR CONFLICT OF INTEREST TO MAKE.
Soft Tissue Sarcoma

Rare neoplasm of connective tissue elements.
- 80% - soft tissue, mesenchymal system.
- 50% arise in extremities.
- 20% - bone.

Presentation often delayed –
- Slow growing.
- Painless.
- Lack of constitutional symptoms.
Diagnosis

High index of suspicion!

Clinical history and examination.

Imaging protocol.
- When to image the lesion?
- Radiographs or CT or MRI?

Who to refer the patient to for biopsy?

Purpose of Imaging
- Characterise.
- Localise.
- Stage.
- Plan treatment.
- Assess response to therapy.
Radiographs

Limited value in soft tissue sarcoma.
- Outline / capsule.
- Calcification / ossification.
- Associated bony lesions.

Chest Radiograph.
- Essential – lung nodules.
- Nodules < 4 mm may not be evident.

Marginal or internal calcification seen in 10-30% of Synovial Sarcoma.

Liposarcomas may be seen as more lucent areas. Up to 30% of dedifferentiated liposarcomas show internal calcification.
Ultrasound

Limited role.

Initial evaluation of peripheral lump.

Cystic vs solid.

Vascularity.

Role in image guided biopsy limited.

Lipomas and Liposarcomas both appear iso-echoic to fat and may both show septations and a lobulated outlines.

Liposarcomas tend to be slightly hypervascular.
Computed Tomography (CT)

Intravenous contrast enhanced study.
But, tissue contrast resolution is low.

Staging scans –
- Lung nodules.
- Metastases and nodal involvement.

Retroperitoneal sarcomas.
- Diagnosis.
- Follow up imaging for recurrences.

Retroperitoneal sarcomas
• 10-20% of all sarcomas.
• Often present late as large potential space to grow in.
• Non-specific symptoms.
• Need to differentiate from lymphoma.
• Vascular involvement affects treatment choices.
ABCs of Soft Tissue Sarcoma Imaging

Computed Tomography
ABCs of Soft Tissue Sarcoma Imaging

Angiography

Lesion vascularity and blood supply.

Pre-surgical embolisation.

Vascular neoplasms like haemangiopericytoma, haemangioendothelioma and angiosarcoma can affect both bone and soft tissues and often presents with bleeding.

Angiosarcoma is an aggressive malignancy with high local recurrence and distant metastases.
ABCs of Soft Tissue Sarcoma Imaging

Nuclear Medicine

Tc99m BONE SCANS
Whole body imaging for low radiation dose.
High uptake in areas with bone repair or high turnover.
Lytic destructive lesions may give false negatives.

Part of initial imaging workup.
PET-CT/PET-MRI

18FDG – most common.
Tumour or physiologic tissue metabolism.
CT/MR scanning – gives concurrent anatomical and functional imaging findings.

Localisation of metabolically active component of the soft tissue sarcoma for optimal biopsy targeting.

Detection of local recurrence and metastases.
Assess response to neoadjuvant chemotherapy.

45 M with pectoral histiocytoma. Bone metastases were found with FDG PET-CT.

Non-neoplastic findings like fractures, sarcoid, synovial chondromatosis and infection may also show high SUV levels and give false positives.
Magnetic Resonance Imaging (MRI)

Preferred imaging modality.
Superior tissue contrast resolution.
Detect subtle changes in lesion, delineate margins and assess invasion and spread.
Unable to predict actual histology

TSE/FSE – ↓ scan times and movement artefacts.
STIR/TIRM – abnormal fluid accumulation.
DWI – abnormal fluid movement or restrictions.
IV Contrast essential.

MRI features
• T1 intermediate to low.
• T2 high to intermediate.
• enhancement pattern variable but need to differentiate from peritumoral oedema.

Malignant features
• > 5 cm.
• deep location.
• absent central enhancement.
• pseudocapsule.
• does not respect fascial borders and anatomic compartments.
• heterogeneous.
ABCs of Soft Tissue Sarcoma Imaging

MRI

Whole body MRI is controversial.

Localise to single body region.

Include entire long bone or entire spine.

MR of additional body region may depend on CT or PET/CT findings.
ABCs of Soft Tissue Sarcoma Imaging

Staging

Based on
• tumour grade
• size
• location.

Classification Systems

• Enneking System.
• AJCC System.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Grade</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>Low, G₁</td>
<td>Intracompartmental, T₁</td>
</tr>
<tr>
<td>IB</td>
<td>Low, G₁</td>
<td>Extraparenchymal, T₂</td>
</tr>
<tr>
<td>IIA</td>
<td>High, G₂</td>
<td>Intracompartmental, T₁</td>
</tr>
<tr>
<td>IIB</td>
<td>High, G₂</td>
<td>Extraparenchymal, T₂</td>
</tr>
<tr>
<td>III</td>
<td>Any G</td>
<td>Any T with metastases</td>
</tr>
</tbody>
</table>

Histologic grade (G)

- G₁: Well differentiated
- G₂: Moderately well differentiated
- G₃: Poorly differentiated
- G₄: Undifferentiated

Primary site (T)

- T₁a: Superficial tumor ≤5 cm in diameter
- T₁b: Deep tumor >5 cm in diameter
- T₂a: Superficial tumor ≤5 cm in diameter
- T₂b: Deep tumor >5 cm in diameter

Nodal involvement (N)

- N₀: No histologically verified lymph node metastases
- N₁: Histologically verified regional lymph node metastases

Distant metastases (M)

- M₀: No distant metastasis
- M₁: Distant metastasis present

Stage   | Classification                          | G – Grade | M – Metastases | N – Node | T – Tumour |
-------|-----------------------------------------|-----------|----------------|---------|-----------|
I       | G₁₂, T₃, any N₀ M₀                     | G₁,₂      | T            | N₀      | M₀        |
II      | G₃₄, T₁a,₁b,₂a,₂a N₀ M₀                | G₃,₄      | T₁a,₁b,₂a    | N₀      | M₀        |
III     | G₃₄, T₂b N₀ M₀                         | G₃,₄      | T₂b          | N₀      | M₀        |
IV      | G₃₄, T₂b N₀ M₀ or G₃₄, T₂b N₀ M₀,₁     | G₃,₄      | T₂b          | N₀,₁    | M₀,₁      |
ABCs of Soft Tissue Sarcoma Imaging

Imaging Findings

MR Signal Characteristics

- T1w, T2w
- Enhancement

Location –

- deep or superficial.
- subcutaneous, intermuscular, intramuscular.
- adjacent structures – eg bone, solid organs.
- neurovascular bundle.
- invasion or clear fat-plane.
- wide margin of excision possible?
- amenable to image guided biopsy?
- radiosensitive organs if planning for radiotherapy.
21 M Synovial Sarcoma
21 M Synovial Sarcoma

Text
21M Synovial Sarcoma (cont.)
55F Myxofibrosarcoma

July 2011
55F Myxofibrosarcoma (Cont.)

January 2012   February 2012
55F Myxofibrosarcoma (Cont.)

Lower extremity 50%, upper extremity 25%, retroperitoneum 15%.
Deep intramuscular 70%. Subcutaneous 5-10%
T1w intermediate signal.
T2w intermediate to high signal.
Heterogeneous – collagen, myxoid tissue, necrosis +/ haemorrhage.
Fibrous pseudocapsule – well defined margins.
Destruction of adjacent bone.
39F Myxoid Liposarcoma
ABCs of Soft Tissue Sarcoma Imaging

39F Myxoid Liposarcoma (Cont.)

Intermediate to high grade malignancy.
~ Round cell component.
MR Features
• Well-defined, multilobulated.
• T1w ↓.
• T2w ↑.
• <10% adipose tissue – lacy/linear T1w ↑.
• Enhancement
  o peripheral nodular (60%)
  o central (45%)
  o diffuse (15%).
37F Well Differentiated Liposarcoma

Low grade malignancy.
Recurs locally.
Does not metastasise.
Locations –
• lower extremities 50%
• retroperitoneum 20-33%
• upper extremities 14%
• trunk 12%
Retroperitoneal lesions have 90% recurrence rate post resection.
Over 75% of mass is adipose tissue.

Thick septa, maybe enhancing.

Focal nodular regions (<2 cm in size usually). If >3cm dedifferentiated?

Moderate to marked enhancement.

PET CT – local recurrence one year post resection.
40F Pleomorphic Sarcoma

Previously MFH.
- Similar imaging features to myxofibrosarcoma.
- CT shows lobulated heterogeneous mass with necrosis and haemorrhage, with variable enhancement.
- Engulfs surrounding neurovascular structures.

Images courtesy of Dr Lionel Cheng, SGH
Lipoma

Most common soft tissue neoplasm.
Superficial > deep location.
80% < 5 cm.
Capsulated or non-encapsulated.

MR - T1w and T2w ↑ signal.
Need Fat-Suppressed T1w to confirm.
Up to 30% may have septa or nodularity.

CT – low attenuation, mostly homogeneous.
 Unable to accurately diagnose the histology of the soft tissue sarcoma.

Imaging features are non-specific and indeterminate with current imaging modalities.

Imaging guided percutaneous or surgical open biopsy. Consultation with Orthopaedic surgeon to determine route for biopsy and potential for wide resection to avoid seeding of track.
Protocol for Imaging

Radiographs/X-Rays – lesion and chest.

MRI
- Diagnosis and post surgical surveillance.

CT
- if MRI contra-indicated.
- Thorax – for lung nodule detection.
- Abdomen and Pelvis – staging study.

Radionuclide Tc99m Bone Scan
- Bone involvement.

PET/CT or PET/MR
- Local recurrence or metastatic disease.

Angiography
Protocol for Imaging

Radiographs/X-Rays – lesion and chest.

MRI
- Diagnosis and post surgical surveillance.

CT
- if MRI contra-indicated.
- Thorax – for lung nodule detection.
- Abdomen and Pelvis – staging study.

Radionuclide Tc99m Bone Scan
- Bone involvement.

PET/CT or PET/MR
- Local recurrence or metastatic disease.

Angiography
Protocol for Imaging

Radiographs/X-Rays – lesion and chest.

MRI
- Diagnosis and post surgical surveillance.

CT
- if MRI contra-indicated.
- Thorax – for lung nodule detection.
- Abdomen and Pelvis – staging study.

Radionuclide Tc99m Bone Scan
- Bone involvement.

PET/CT or PET/MR
- Local recurrence or metastatic disease.

Angiography
Thank you!

This presentation contains information which is confidential and/or legally privileged. No part of this presentation may be disseminated, distributed, copied, reproduced or relied upon without the expressed authorisation of SingHealth.