A 29 yr-old man with a lesion of the distal femur
A case report

Bryce Wolf, Harvard Medical School III
Gillian Lieberman, MD
Clinical History of Our Patient, A.O.

CC: 29 yr-old male with 3 month history of pain and mass in left lower thigh

PMH: 8/09/04 hit by car and sustained grade I open fracture of left tibia (requiring internal fixation) and fibula

PE: Large, non tender mass of entire left thigh ending just superior to patella. No overlying superficial erythema. Distal neurovascular status intact.
An AP and lateral plain film of his left femur was then obtained.
Location is circumferentially around the distal left femoral metaphysis with sparing of knee jt
Roentgen Findings

- Indistinct margin
- Sunburst periosteal reaction
- Longitudinal periosteal reaction
- Codman triangle
- Osteoid Matrix

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### Clinical Approach to Findings

#### Indolent vs. Aggressive Findings

<table>
<thead>
<tr>
<th>Morphology</th>
<th>Indolent</th>
<th>Aggressive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesion border</td>
<td>Sharp, sclerotic</td>
<td>Ill-defined</td>
</tr>
<tr>
<td>Bone destruction</td>
<td>Geographic</td>
<td>Motheaten Permeative</td>
</tr>
<tr>
<td>Periosteal reaction</td>
<td>Solid buttress, Single lamellar, Undulating</td>
<td>Sunburst, Codman triangle, Lamellated</td>
</tr>
<tr>
<td>Soft tissue mass</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Our roentgen findings are consistent with an aggressive lesion.
Clinical Approach to Findings

Aggressive or indolent?

Focal or systemic?
A Tc-99m bone scan was then obtained to answer this question.
Tc-99 Bone Scan

Increased tracer activity in left distal femoral diaphysis

Linear activity represents bone remodeling of left tibia (remember the left tibial traction rod!)
Clinical Approach to Findings

Aggressive or indolent?

Focal or systemic?

Further Imaging + Biopsy
  - MRI
  - Thoracic CT
  - CT-guided
  - Open
Working the DDX

Focal or Systemic?

Tumor
Trauma
Infection
Infarction

+ Clinical Hx
Age/sex
PHM
symptoms

+ Rad Signs
Osteoid matrix

Trauma
Myositis Ossificans
(heterotopic ossification)

Aggressive Tumor

Myositis Ossificans (heterotopic ossification)
**Working the DDX**

**Trauma**
Myositis Ossificans (heterotopic ossification)  

**Aggressive Tumor**
- High-grade Osteosarcoma  
- Less aggressive osteosarcoma subtype  
- Malignant fibrous histiocytoma  
- Ewings sarcoma  
- Chondrosarcoma

1. Mature M.O. 1 yr post trauma sclerotic border and immature ossification (radiolucent)  
2. Rarely circumferentially around bone and as expansive
Myositis Ossificans

Companion patient #1 – Plain Film

Companion patient #1 - CT

Saifuddin A, Parikh J. The imaging features of post-traumatic myositis ossificans, with emphasis on MRI. Clinical radiology 2002; 1058:1066.
Working the DDX

Aggressive Tumor

- High-grade Osteosarcoma
- Less aggressive osteosarcoma subtype
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Trauma

- Myositis Ossificans
  - (heterotopic ossification)

1. Mature M.O. 1 yr post trauma
   - sclerotic border and immature ossification (radiolucent)
2. Rarely circumferential around bone and as expansive

1. Location – 40% in distal femoral metaphysis
2. Multiple periosteal rxn
3. *Extensive osteoid matrix
Path Report of Biopsy on Our Patient

High grade osteosarcoma
CT and MRI imaging was next used to stage his tumor
Tumor Staging: CT Scan

- Full CT of thorax
- 80% of mets involve the lung
- Reported 20% present with pulmonary mets A.O. does not have lung mets
- A.O. clear of lung mets

Companion patient #2

Rt lower lung lobe

http://www.gentilli.net/diagframe.asp?ID=.3221&URLID=42325&diag=Osteosarcoma
Surgical planning

• Tumor compartmentalization
• Proximity to epiphysis and articular cartilage
• Proximity to neurovascular bundle
Coronal STIR MRI of Our Patient

T2 w/ fat sat
Coronal STIR MRI of Our Patient
Coronal STIR MRI of Our Patient
Coronal STIR MRI of Our Patient
Epiphysis/Articular Cartilage

Epiphyseal extension
Cartilage clear?
Coronal STIR MRI of Our Patient
Coronal STIR MRI of Our Patient
Compartmentalization

Intramedullary high signal

Medial compartment

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Coronal STIR MRI of Our Patient

[F]

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Coronal STIR MRI of Our Patient

[F]

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Compartmentalization
Axial T1 High Res of Our Patient
Compartmentalization

Anterior compartment

Tumor

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Proximity to NVB

Femoral A/V + Deep femoral A/V of thigh

Sciatic Nerve

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Proximity to NVB
Proximity to NVB
Proximity to NVB

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Proximity to NVB

- Popliteal A/V
- Tibial and common peroneal nerves
Proximity to NVB

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Proximity to NVB
Proximity to NVB

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Conclusions

1. Left femoral A/V displaced medially

2. Left sciatic and peroneal/tibial displaced posteriorly

3. NVB distally intact

4. Tumor invasion?
Invasion of Popliteal Artery

Companion patient #3

MRI High Sensitivity, Low Specificity

- Very sensitive to peri-neoplastic edema
- No specificity – tumor or reactive edema?
- Contrast enhancement non-specific
- Must resect beyond perineoplastic reactive zone
Skip Lesions

• Definition: tumor foci at a location distant from the primary tumor but within the same anatomical compartment.
• Likely from tumor hematogenous spread
• Indicates a worse prognosis
Skip Lesions
Companion patient #4 - MRI

A suspected skip lesion was found on a MRI scan of our patient’s proximal femur.
Suspected Skip Lesions of Our Patient

MRI

CT

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A CT-guided core needle biopsy was needed to rule out a skip lesion
CT-Guided Core Needle Biopsy of Our Patient

Results Negative
Treatment for A.O.

- Neoadjuvant Chemotherapy (4 mo pre-op for A.O)
  - Pre and post-operative
  - Target and treat microscopic metastatic disease
  - Decrease tumor size
    - no appreciable decrease in size for A.O
  - Response to chemotherapy
    - Measure by change in tumor size
    - MRI cannot detect necrotic changes

- Resection and Reconstruction
  - Neurovascular bundle intact
  - Avoided lower extremity amputation
  - Hinged distal femur replacement and total knee prosthesis
Hinged distal femur replacement and total knee prosthesis
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- Dr. Mary Hochman, M.D.
- Dr. Ferris Hall, M.D.
References

• Saifuddin A, Parikh J. The imaging features of post-traumatic myositis ossificans, with emphasis on MRI. *Clinical radiology* 2002; 1058:1066.