

When Leg Pain Isn't Growing Pain: Osteosarcoma in the Adolescent Athlete and How to Recognize it in Your Clinical Practice

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Objectives

- Understand the presentation of Osteosarcoma in the adolescent including the pattern of pain, as well as the typical age and location
- Know of other bone tumors that may present in this same age group and thus have a better differential diagnosis for unusual pain
- Have a basic understanding of the workup and treatment of primary bone tumors



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Bone Tumor

- Mark Herzlich
 - Boston College star linebacker, Junior
 - ACC defensive player of the year
- 6'4" 240
- As of May 1st, 2009, #2 rated college linebacker for 2010 NFL draft
- Left thigh pain
- Orthopaedic Oncologist 5/12/09
- Biopsy left femur 5/13/09
- Press conference 5/14/09



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Bone Tumors

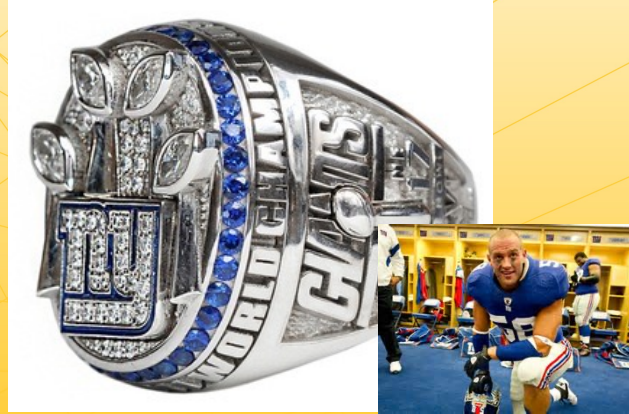
- Ewing's Sarcoma left femur
- Chemotherapy
- Post chemo radiation done
- Prophylactic nail to left femur
- Return to play 2010
 - 3 interceptions
- Undrafted: Signed by Giants
 - First start 11/20/2011
 - 2014 was best year



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Super Bowl Champion



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Overview

- What is osteosarcoma?
- Incidence, location and age
- Diagnosis
- Treatment
- Prognosis
- Examples
- Follow up

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Osteosarcoma

- Cancerous bone tumor
- One of a few that adolescents may have
 - Ewing sarcoma
- Can spread
 - Lungs
 - Bone



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Osteosarcoma Background


- 0-19 years old: incidence 5 per million
- Slightly more male than female
- Peaks at 10-14 years and > 65
- Mostly metaphyseal: bone flair near end
- Femur 42% (75% of those are distal)
- Tibia 19% (80% proximal)
- Humerus 10% (90% proximal)
- Pelvis 8%



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Diagnosis

- History
- Exam
- Imaging
 - Xray
 - MRI
- Biopsy
- Lab tests?
- Staging studies
- Differential



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Diagnosis


- History
 - Progressive increasing pain: weeks to months
 - Gradual swelling
 - Aggravated by activity or not activity related
 - Pain worse/longer than expected from activity or injury
 - **Whole picture does not fit**
- Exam
 - Hands on exam helpful
 - Compare to other side
 - Mild swelling and tenderness



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Diagnosis

- Imaging
 - Xray
 - Periosteal elevation
 - Permeative, destructive
 - Bone formation
 - MRI
 - Soft tissue mass
 - Marrow extent
 - Skip metastases
 - Whole bone

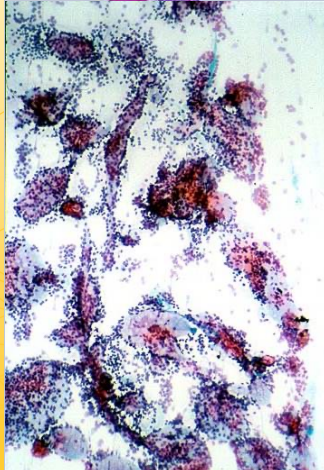


MSH_MN_CR2
EX: RT LATERAL
Se: /2
Im: 1/1
Acc: 000370360
2002 Aug 20
18:49:55.237
DISTAL FEMUR
SUPINE
Mag: 1.0x
W:2878 L:1340

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Diagnosis

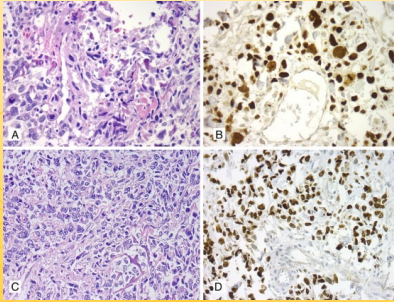
- Biopsy
 - Open
 - Core
 - Fine needle aspirate
 - May lose matrix relationship
 - Not preferred




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Pathology Tests

- No diagnostic tests
 - SATB2: preosteoblast marker may help
 - Abnormal bone formation (malignant osteoid)
 - Malignant looking cells



| Machado et al, Pathology - Research and Practice, September 2016, Pages 811-816

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Diagnosis

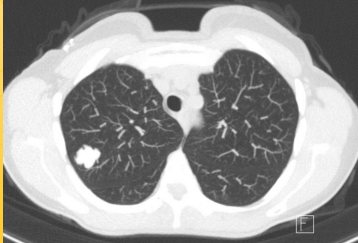
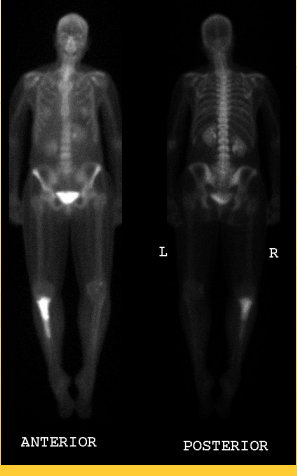
- Blood tests?
 - Nothing diagnostic
 - High levels: worse prognosis
 - Alkaline Phosphatase
 - Lactate Dehydrogenase

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Diagnosis


- Staging studies
 - Check lungs and bones
 - MRI of entire bone
 - Total body PET/CT
 - Looks at glucose uptake
 - Detection of masses 1 cm+

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Diagnosis

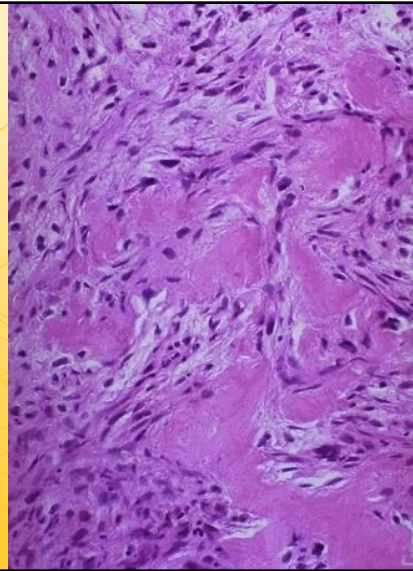
- Differential
 - Ewing sarcoma
 - Cancerous
 - More likely that OGS to be seen in spine, pelvis, small bones
 - Similar staging and pattern of treatment
 - Osteoblastoma
 - Benign
 - Bone forming
 - Often diaphyseal
 - Myositis
 - Normal bone, calcified muscle

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Histopathology

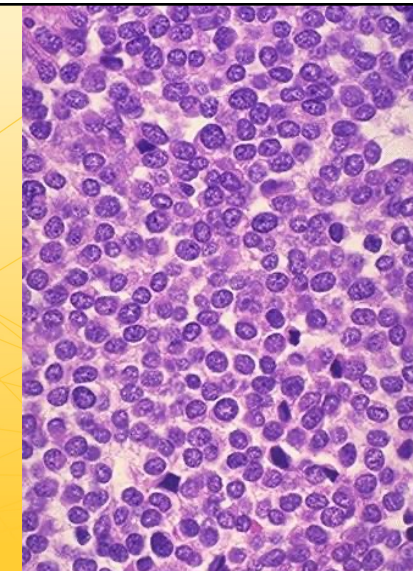
- Osteosarcoma
 - Osteoid and malignant cells
 - Grade
 - Low: hypocellular, minimal atypia
 - High: pleomorphic, mitoses, cellular



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Histopathology


- Ewing's Sarcoma
 - Small round blue cells
 - EWS/FLI-1 fusion gene from t(11:22) translocation
 - CD99 +




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Management

- Chemotherapy
 - Neoadjuvant
 - Adjuvant
- Surgery
 - Resect all tumor
- Radiation
 - Limited role
 - Unresectable
- Follow up




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Chemotherapy


- Neoadjuvant (preop)
 - Up to 4 cycles
 - Became traditional when prostheses were custom made, taking 3 months
- Adjuvant (postop)
 - 4-6 cycles
 - Change regimen if % necrosis is low (less than 90%)

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Surgical Treatment


- Wide resection
 - Amputation
 - Turn-up/rotation plasty
 - Geometric resection with bulk allograft
 - Epiphysis sparing with segmental allograft
 - Osteoarticular allograft
 - Vascularized fibula alone or to supplement allograft
 - Allograft prosthetic composite
 - Expandable prosthesis
 - Endoprosthesis



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Prognosis

- Surgery and no chemotherapy
 - ~20% survival
 - ~80% present with at least micrometastatic disease
- Current survival 60-70%
 - 50% of patients saved by chemotherapy
 - 30+% relapse despite chemotherapy
 - ~20% did not need chemotherapy



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Prognosis

SEER stage	5-year relative survival rate
Localized	77%
Regional	64%
Distant	27%
All SEER stages combined	60%

- SEER, Surveillance, Epidemiology and End Results: US database
- Patients with access to chemotherapy and surgery



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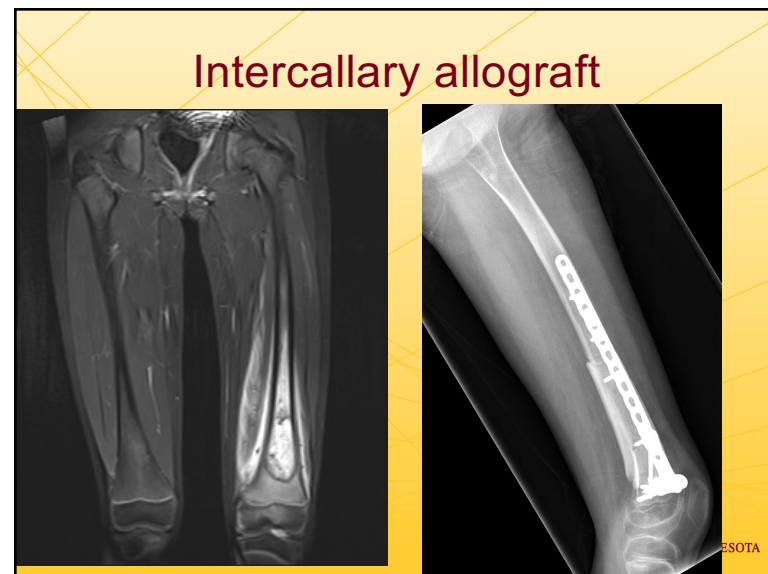
Osteosarcoma



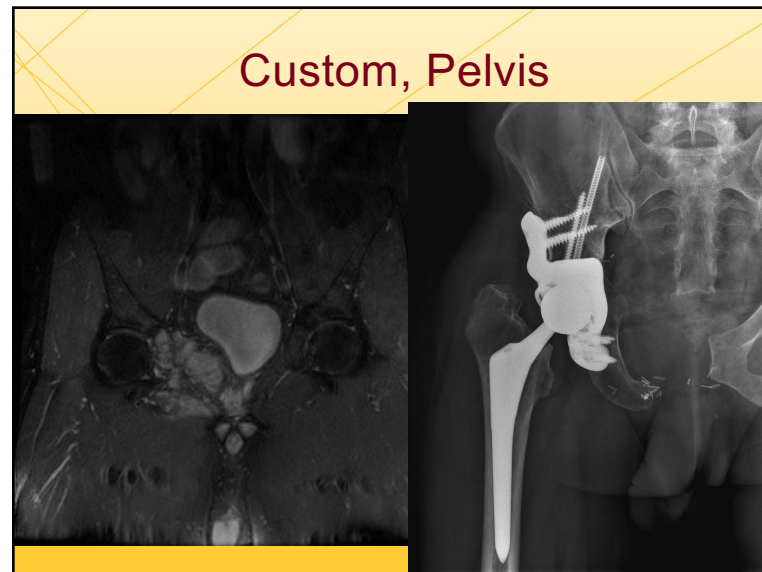
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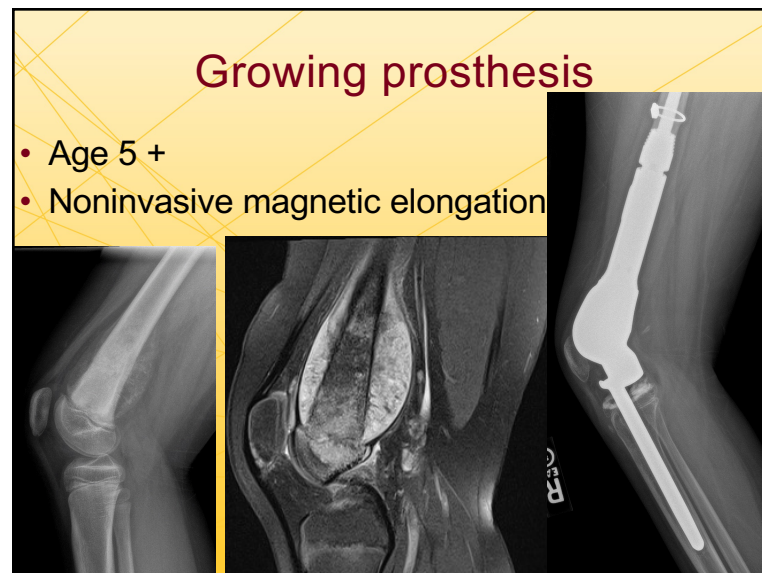
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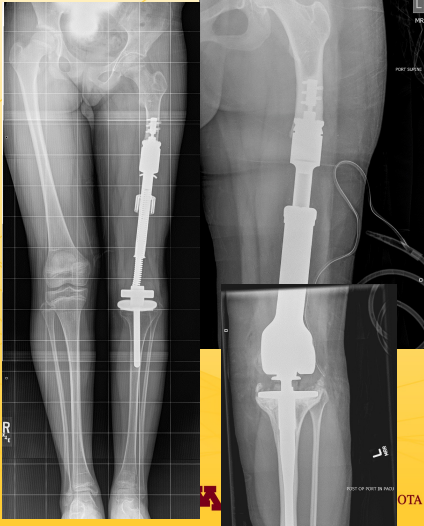
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Complications


- Noninvasive expandable with Repiphysis
- Repiphysis failed
- Expansion stopped short
- Tibia growth plate slowed
- Little knee flexion
- PF arthritis



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Follow up

- Exam
- Restaging
 - Chest imaging: CT vs xray
 - Primary site: Xray vs MRI
 - Metal artifact
 - National Comprehensive Cancer Network (NCCN)
 - Every 3 months x 2 years
 - Year 3 q 4 mo
 - Year 4-5 q 6 mo
 - Then yearly...
 - PET/CT or bone scan yearly?



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