

AMSER Case of the Month

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17-Year-Old Male who presents with painful scoliosis



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Patient Presentation

- **HPI:** 17 YO male who presents for a scoliosis evaluation with history of chronic back pain. Pt does have a family hx of scoliosis and has never been evaluated for scoliosis previously. Pt is active in marching band and competitive bowling league.
- **PMhx:** None
- **Medications:** None
- **Social Hx:** NA

Patient Objective Data

- **MSK Exam:**
 - **Gait:** Upright normal gait, no leg length discrepancy present
 - **Adam's test:** Right thoracic rib hump, while standing there is a right-sided truncal shift, no shoulder asymmetry
 - **ROM:** Full active range of motion in forward, extension, and lateral bending
 - **Neuro:**
 - **Strength:** Normal: 5/5 in all extremities
 - **Reflexes:** Normal: 2+ Patellar tendon
 - **Babinski:** Negative
 - **Clonus:** Positive, abnormal sustained clonus in LLE

What Imaging Should We Order?

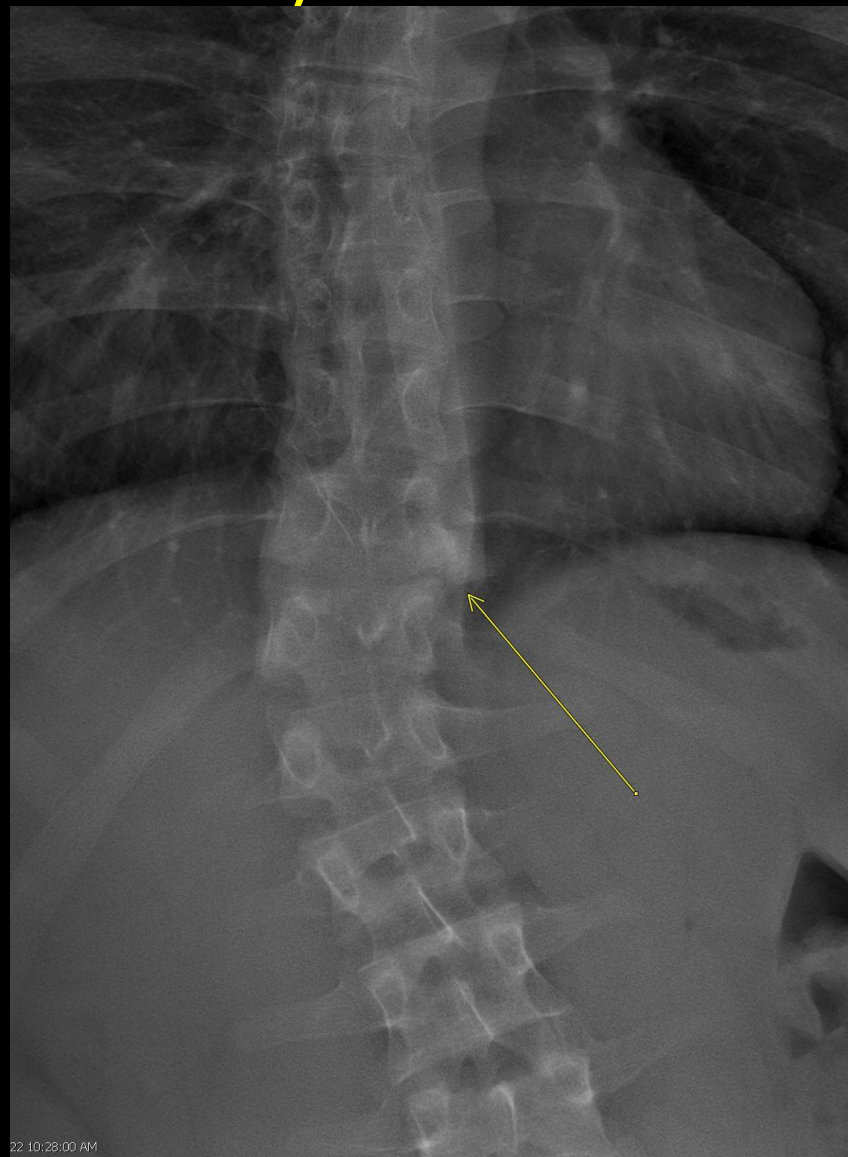
Select the applicable ACR Appropriateness Criteria

Ped 10-18y, scoliosis, idiopathic, cervical and thoracic spine, risk factors	Radiography complete spine	Null	0.3-3 mSv [ped] ⊗⊗⊗	Usually appropriate	●
	MRI complete spine without IV contrast	0 mSv ○	0 mSv [ped] ○	Usually appropriate	●
	MRI complete spine without and with IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
	CT cervical and thoracic spine with IV contrast	10-30 mSv ⊗⊗⊗⊗	Null	Usually not appropriate	●
	CT cervical and thoracic spine without IV contrast	10-30 mSv ⊗⊗⊗⊗	Null	Usually not appropriate	●
	CT cervical and thoracic spine without and with IV contrast	10-30 mSv ⊗⊗⊗⊗	Null	Usually not appropriate	●
	Bone scan complete spine	Null	3-10 mSv [ped] ⊗⊗⊗⊗	Usually not appropriate	●

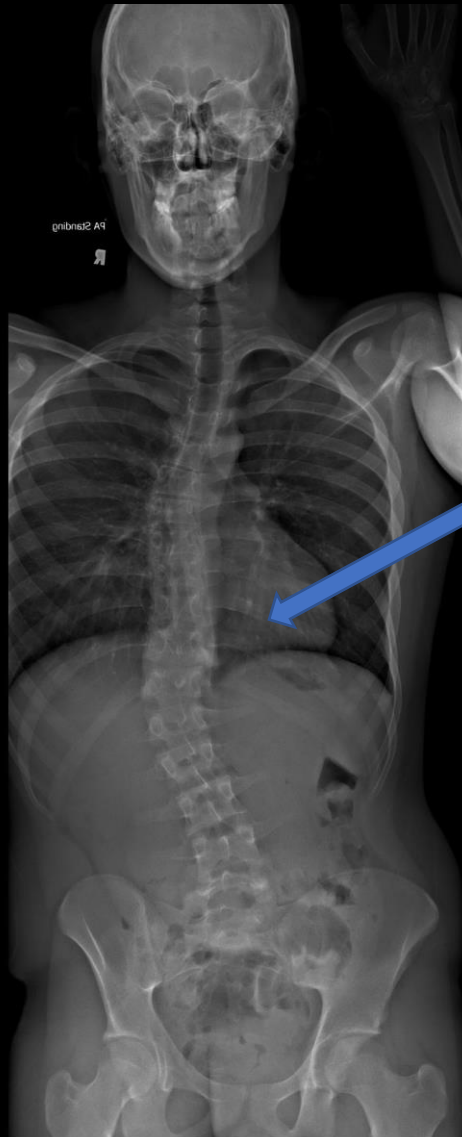
Done in the Orthopaedic office secondary to abnormal Adam's* test and scoliosis on clinical exam.

*Adam's Forward Bending test: Screening test for scoliosis, examinee bends over with feet together and touches their feet. An examiner is looking for the following: unlevel shoulders, scapular asymmetry, unlevel hips, or a rib hump.

Findings (unlabeled)

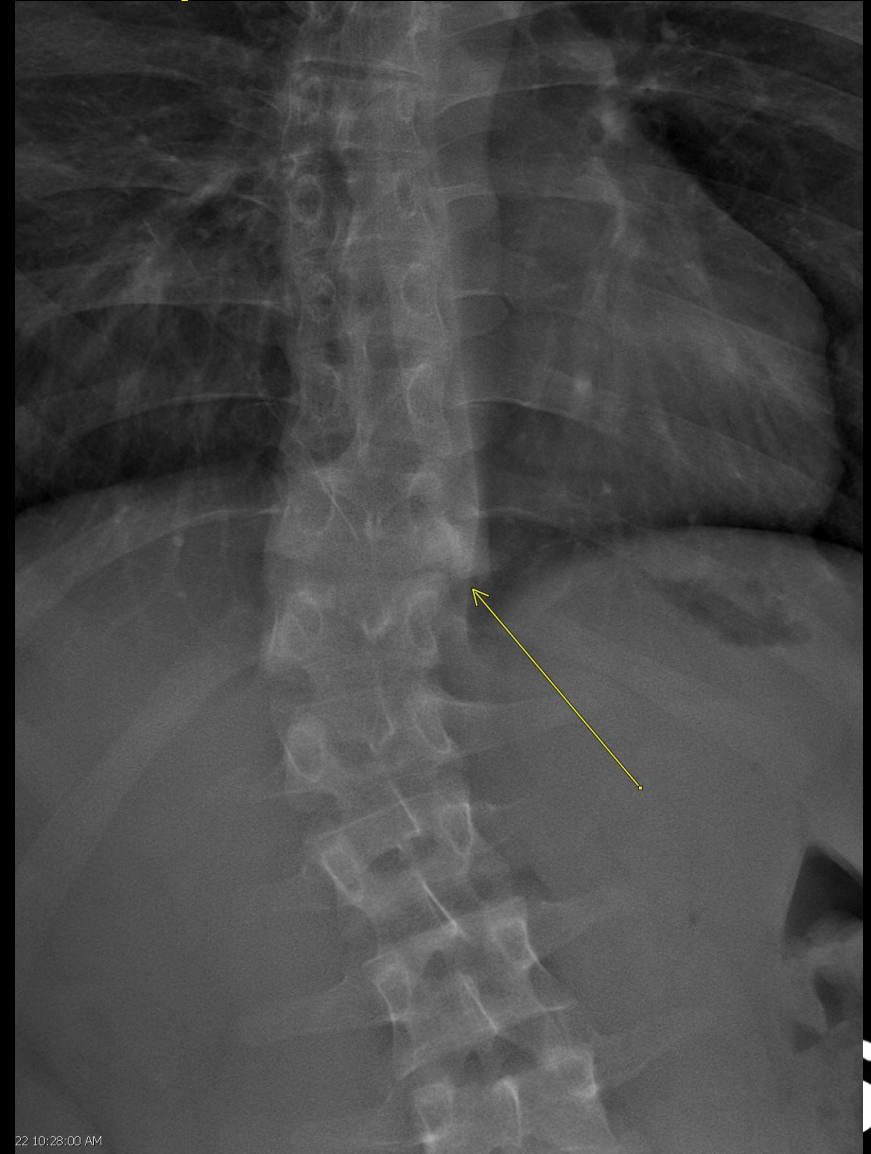


Findings: (labeled)



In office reading: Atypical scoliosis, right thoracic curvature. Curvature is from T4-L3 is approximately 30 degrees

Closer look at T11 demonstrates a sclerotic focus projecting just below the left pedicle (yellow arrow)



ACR Appropriateness Criteria- What's Next?

- Considering the upper motor neuron findings, sustained clonus of the right lower extremity. These findings cannot be adequately explained considering the x-ray findings.
- What should we order next? What is ACR appropriate?

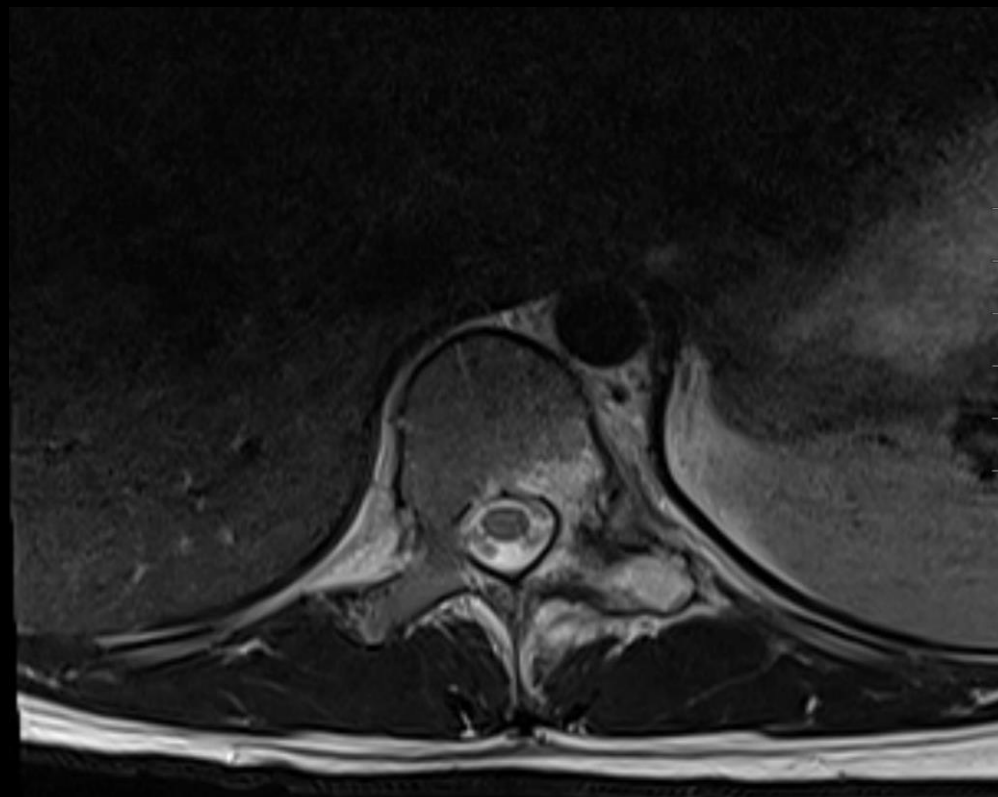
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	CT cervical and thoracic spine with IV contrast	10-30 mSv ⊗⊗⊗⊗	Null	Usually not appropriate	●
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	CT cervical and thoracic spine without and with IV contrast	10-30 mSv ⊗⊗⊗⊗	Null	Usually not appropriate	●
	Bone scan complete spine	Null	3-10 mSv [ped] ⊗⊗⊗⊗	Usually not appropriate	●

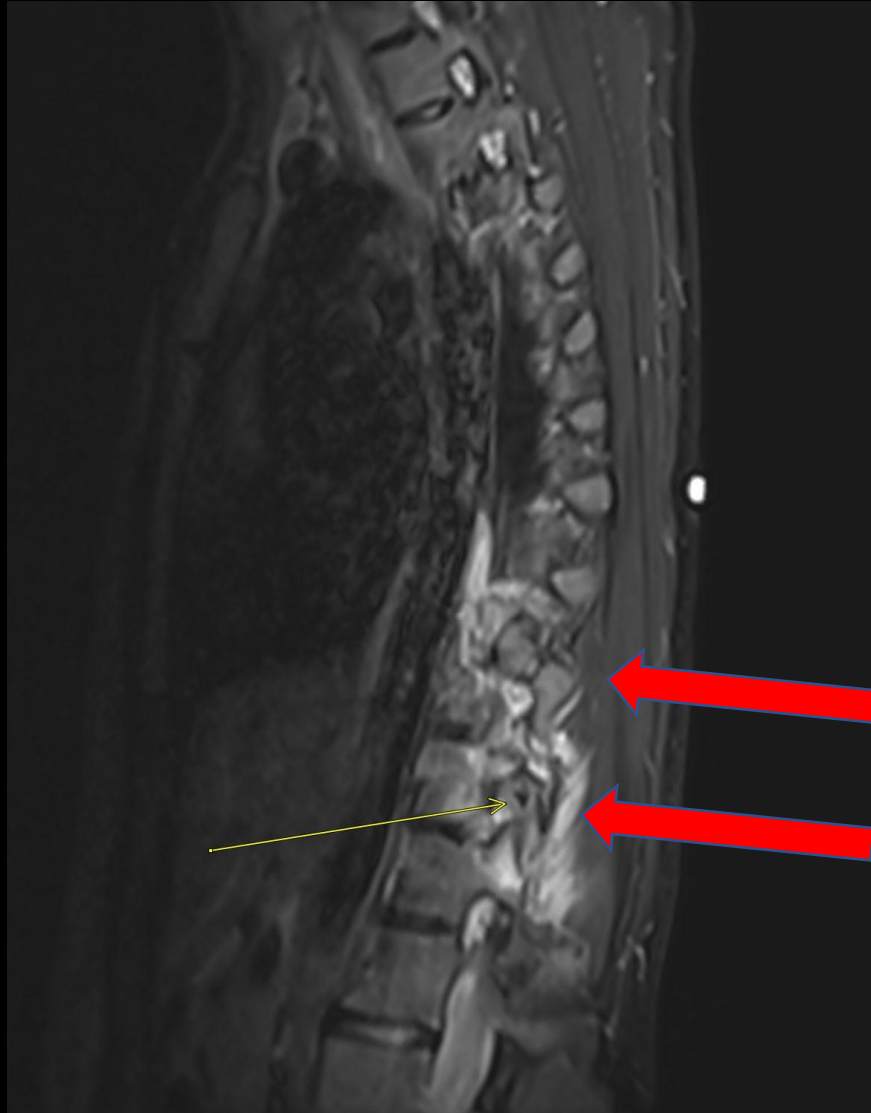
This imaging modality was next ordered by the Orthopaedic physician

Since patient had positive clonus on physical exam, a MRI complete spine without IV contrast was appropriately ordered.

Findings: (Unlabeled)

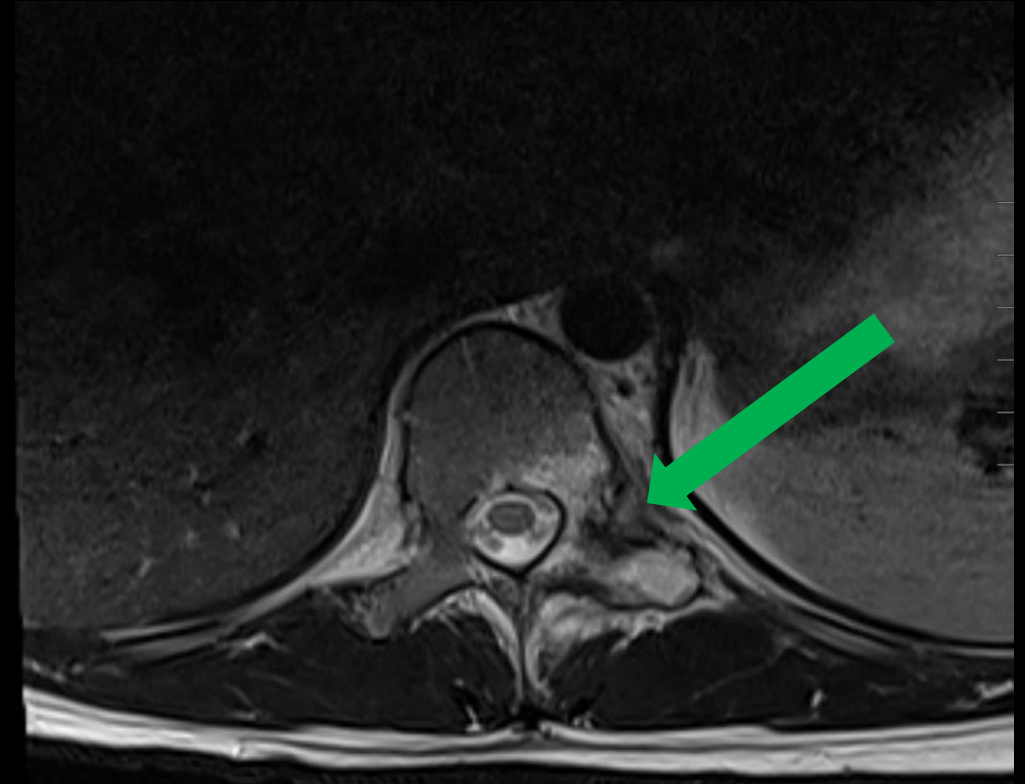


Findings: (labeled)



Green Arrow: Axial T2 weighted MRI. Marrow edema in the left posterior vertebral body, pedicle, and transverse process of T11.

Red Arrow: Sagittal T2 weighted MRI. Marked edema in the left paraspinal musculature around T11. Low signal focus within the left T11 pedicle corresponding to the area of X-ray finding.



Select the applicable ACR Appropriateness Criteria

Primary bone tumor suspected, thoracic spine, osteoid osteoma suspected on xray or clinical exam	CT thoracic spine without IV contrast	1-10 mSv ▲▲▲▲	3-10 mSv [ped] ▲▲▲▲▲	Usually appropriate	●
	MRI thoracic spine without IV contrast	0 mSv ○	0 mSv [ped] ○	May be appropriate	●
	MRI thoracic spine without and with IV contrast	0 mSv ○	0 mSv [ped] ○	May be appropriate	●
	Bone scan whole body with SPECT or SPECT/CT spine	1-10 mSv ▲▲▲▲	3-10 mSv [ped] ▲▲▲▲▲	May be appropriate	●
	CT thoracic spine without and with IV contrast	10-30 mSv ▲▲▲▲▲	3-10 mSv [ped] ▲▲▲▲▲	May be appropriate	●
	Bone scan whole body	1-10 mSv ▲▲▲▲	3-10 mSv [ped] ▲▲▲▲▲	Usually not appropriate	●
	US thoracic spine	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
	CT thoracic spine with IV contrast	1-10 mSv ▲▲▲▲	3-10 mSv [ped] ▲▲▲▲▲	Usually not appropriate	●
FDG-PET/CT whole body	10-30 mSv ▲▲▲▲▲	3-10 mSv [ped] ▲▲▲▲▲	Usually not appropriate	●	

This imaging modality was next ordered by the Orthopaedic physician

MRI findings suggestive of a reactive inflammatory process secondary to potential osteoid osteoma. CT Spine was appropriately ordered to further evaluate etiology of inflammatory response

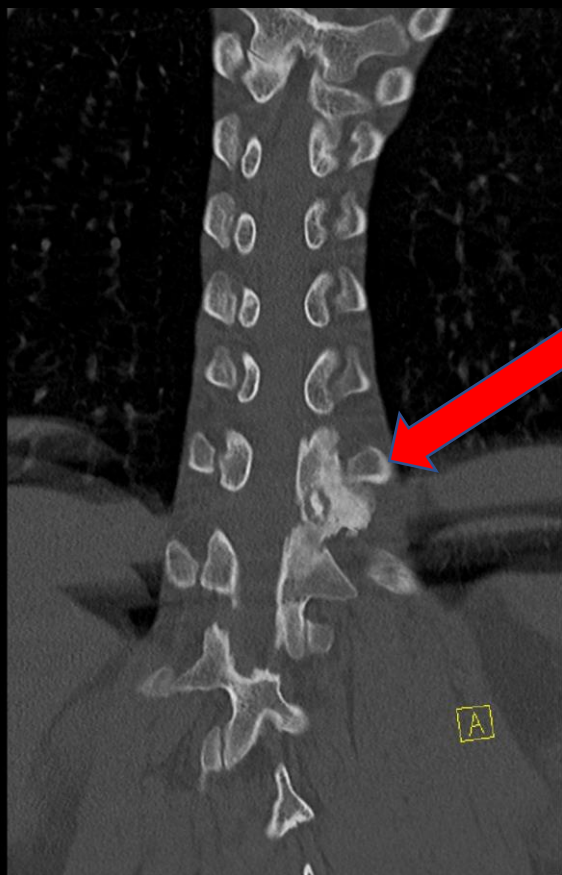
Findings: (unlabeled)



Findings: (labeled)

Red Arrows: Sclerotic nidus in the left T11 pedicle and pars interarticularis junction with lucent soft tissue rind. Perilesional sclerosis in the pedicle and articular facet.

Green Arrow: T11 left pedicle with a central sclerotic nidus



Final Dx:

Osteoid Osteoma

Case: Osteoid Osteoma

- **Epidemiology:**

- Osteoid Osteoma accounts for roughly 10% - 12% of benign bone tumors and 3% of all primary bone tumors
- Commonly develops between 5 to 25 years of age
- Male predominance 2:1 to 3:1
- Approximately 6% – 20% occur in the spine

- **Symptoms:**

- Severe localized pain that is often worse at night
- Relieved with NSAID or aspirin

- **Pathology:**

- Concentric lesion with a nidus of dilated vessels, osteoblasts, osteoid and woven bone. The nidus releases prostaglandins which causes localized pain.

Case: Osteoid Osteoma

- Case:
 - CT thoracic spine was ordered following an incidental finding on MRI of thoracic spine depicting marrow edema of the posterior vertebral body of T11 with extension into the left posterior 11th rib, left 11th pedicle and transverse process
 - Determined to be an osteoid osteoma and no medical intervention has been discussed at this time
 - Patient has been managing back pain with OTC NSAID's with relief

Case: Osteoid Osteoma

- DDX:
 - **Brodie abscess:** radiolucent center and surrounding reactive sclerosis can mimic osteoid osteoma. Intracortical appearance is irregular versus intracortical margins of osteoid osteoma are smooth.
 - Can be distinguished from other primary bone tumors based on size, location, pathology, and clinical symptoms.

Case: Osteoid Osteoma

- **Treatment:**
 - **Non-operative:**
 - NSAID or aspirin therapy for pain management
 - **Surgical Management:**
 - Reserved for pts where NSAID therapy has failed, in pts not willing to tolerate the pain, or at high risk for long-term renal and GI complications from continuous NSAID use
 - **En Bloc Resection:**
 - For sx relief, entire nidus has to be excised
 - **CT guided percutaneous techniques:**
 - Trephine excisions, cryoablation, radiofrequency ablation, laser thermocoagulation
 - RF ablation as a tx has a 91% of clinical success, brief recovery and low complication rate

References:

- Noordin, S., Allana, S., Hilal, K., Nadeem, N., Lakdawala, R., Sadruddin, A., & Uddin, N. (2018). Osteoid osteoma: Contemporary management. *Orthopedic Reviews*, 10(3). <https://doi.org/10.4081/or.2018.7496>
- TEPELENIS, K., SKANDALAKIS, G. P., PAPATHANAKOS, G., KEFALA, M. A., KITSOULI, A., BARBOUTI, A., TEPELENIS, N., VARVAROUSIS, D., VLACHOS, K., KANAVAROS, P., & KITSOULIS, P. (2021). Osteoid Osteoma: An Updated Review of Epidemiology, Pathogenesis, Clinical Presentation, Radiological Features, and Treatment Option. *In Vivo*, 35(4), 1929–1938. <https://doi.org/10.21873/invivo.12459>
- Zhang, Y., & Rosenberg, A. E. (2017). Bone-Forming Tumors. *Surgical Pathology Clinics*, 10(3), 513–535. <https://doi.org/10.1016/j.path.2017.04.006>