WHOLE BODY MRI FOR CHRONIC RECURRENT MULTIFOCAL OSTEOMYELITIS: HOW WE DO IT, WHY WE DO IT LIKE WE DO, AND WHY YOU SHOULD TOO

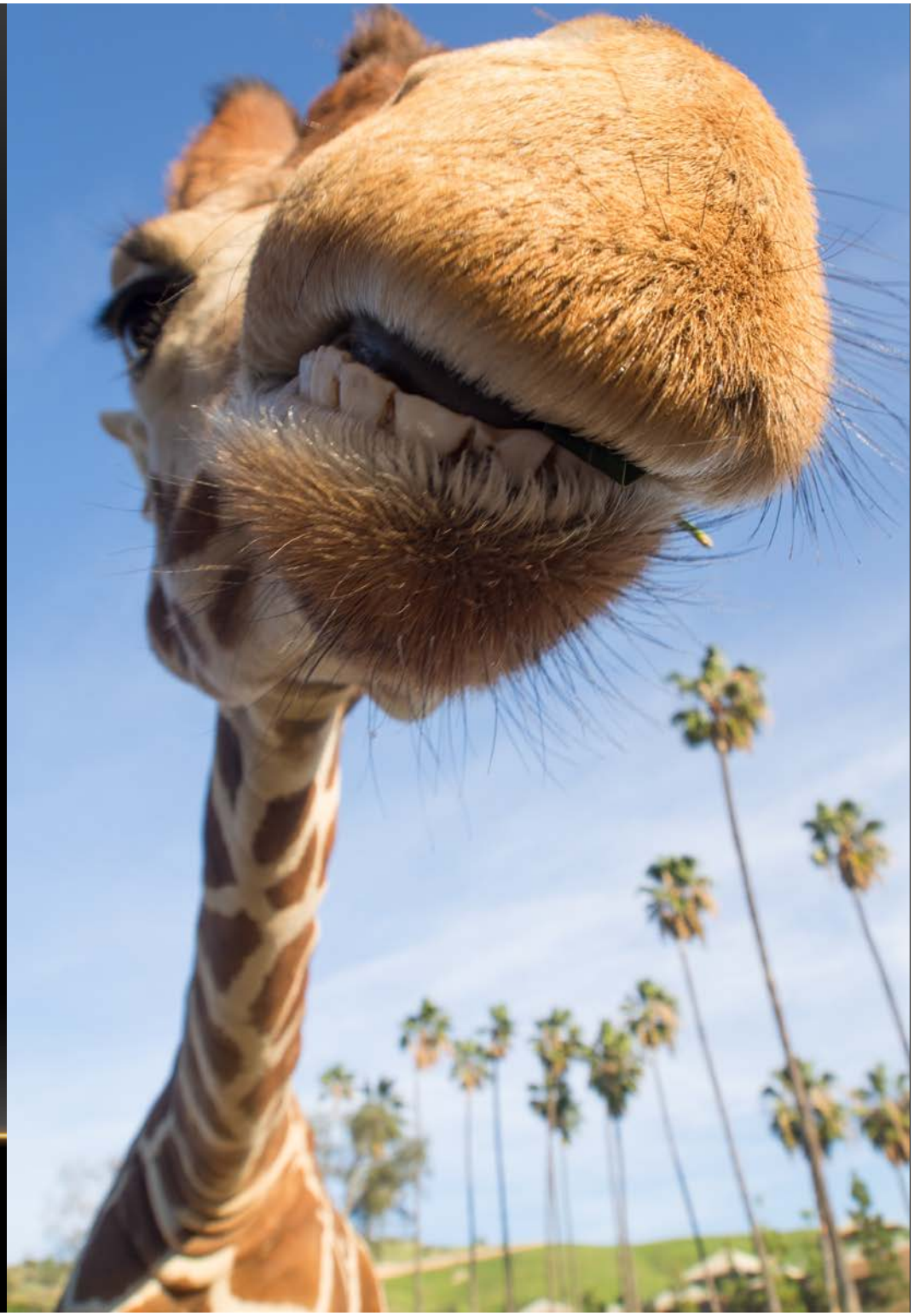
SPR 2017 EDU-058

T. Shawn Sato[1], Manish Bajaj[1], Polly Ferguson[2]

[1]Department of Radiology, University of Iowa, Iowa City, IA USA

[2]Department of Pediatrics, Rheumatology division, University of Iowa, Iowa City, IA USA

NOTHING TO DISCLOSE



LEARNING OBJECTIVES

- Because of the non-specific nature of symptoms and lab findings in chronic recurrent multifocal osteomyelitis (CRMO), it is important for radiologists to be familiar with this disease process to avoid unnecessary procedures (such as biopsies) and ensure timely diagnosis and treatment
- Discuss our rational for creating our whole body CRMO protocol
- Review how we bill for whole body MRIs for CRMO
- Discuss the importance of petitioning the AMA for a CPT code for whole body MRIs

CLINICAL FEATURES OF CRMO

- Idiopathic disorder seen in children and adolescents characterized by multiple sterile inflammatory bone lesions with relapsing and remitting course
- Patients often present with vague symptoms such as pain, swelling or limited range of motion
- While most children present with a single symptomatic site, often other sites of disease present at follow up
- Lab findings are often non-specific, but can demonstrate an elevated ESR and CRP with a normal white blood cell count

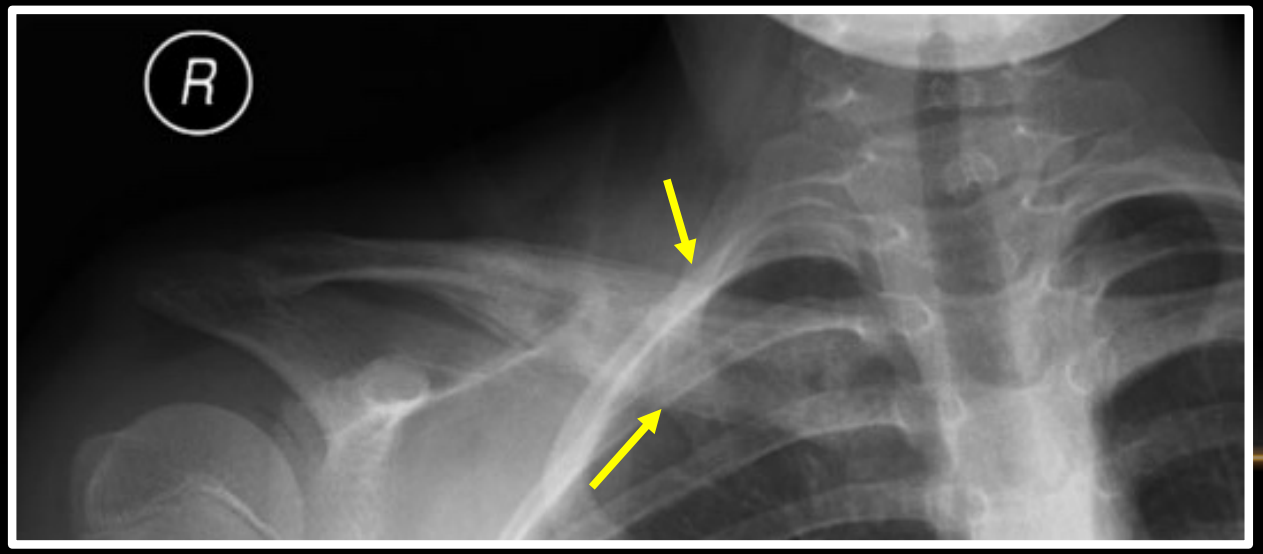
FEATURES OF CRMO

- Associations with CRMO
  - Palmar pustulosis
  - Psoriasis
  - Inflammatory bowel disease (esp Crohns disease)
- Because of associations to autoinflammatory conditions, it is suggestive that CRMO may be autoinflammatory in etiology as well
- Biopsies demonstrate non-specific chronic inflammatory changes without isolation of causitive organism
- NSAID are first line therapy with bisphosphonates and TNF blocking agents being used as needed

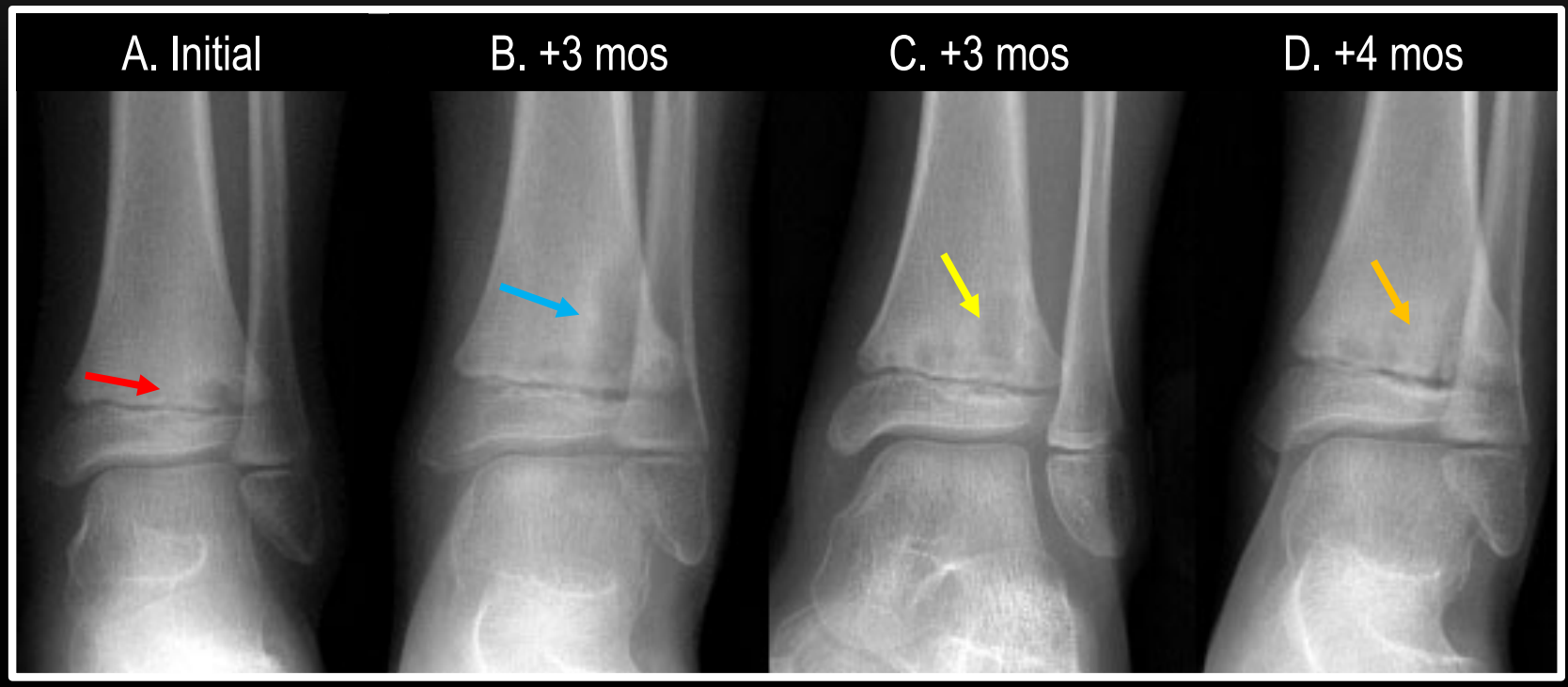
LESION DISTRIBUTION IN CRMO

- Most common sites of involvement are the metaphyses or metaphyseal equivalents of the long bones (most commonly in the lower extremities), but can often be seen in the feet, pelvis, spine and sternum. Other locations can be involved, but are less common

- Involvement of the clavicles and mandible are uncommon, but when they are involved CRMO should be one of the top differentials



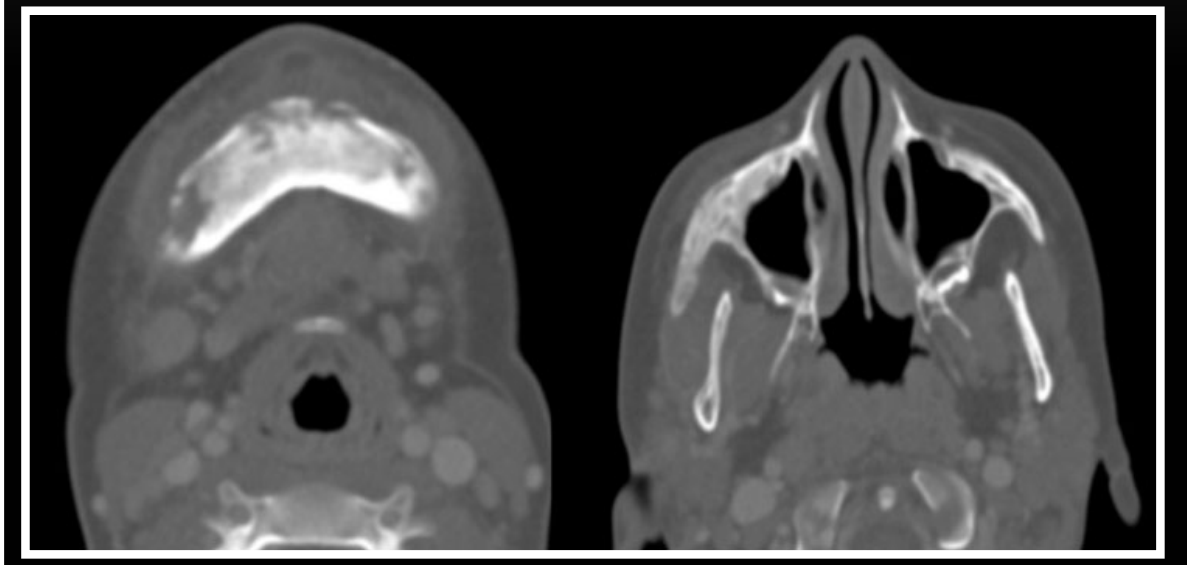
IMAGING FEATURES OF CRMO- PLAIN FILMS EVOLUTION



- Early plain film findings show lytic lesions often adjacent to growth plates (A) that can enlarge (B), become progressively sclerotic (C)

- Lesions can heal with minimal sclerosis (D) or can have marked hyperostosis

IMAGING FEATURES OF CRMO- PLAIN FILMS



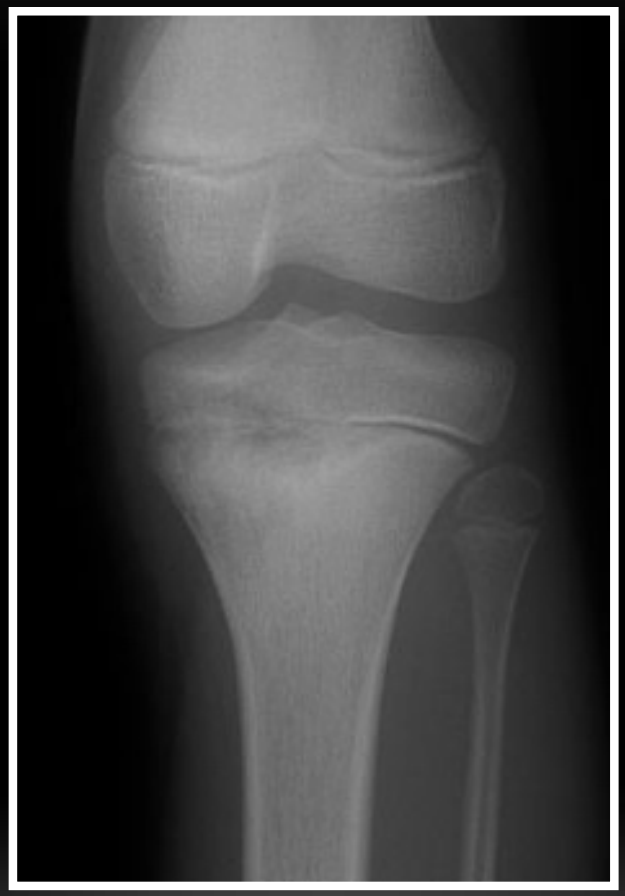
14 yo M with arm pain for 3 years. Distal humerus demonstrates significant hyperostosis. Biopsy negative x 2

8 yo F with mandibular pain and swelling for 10 weeks. CT demonstrates significant sclerosis and expansion of the mandible as well as the maxilla and zygoma

IMAGING FEATURES OF CRMO: MRI

- MRI is more sensitive than plain films for early findings of CRMO such as marrow edema, for which STIR sequences are very sensitive

- MRI can also detect periostitis, soft tissue inflammation, synovitis and transphyseal extension



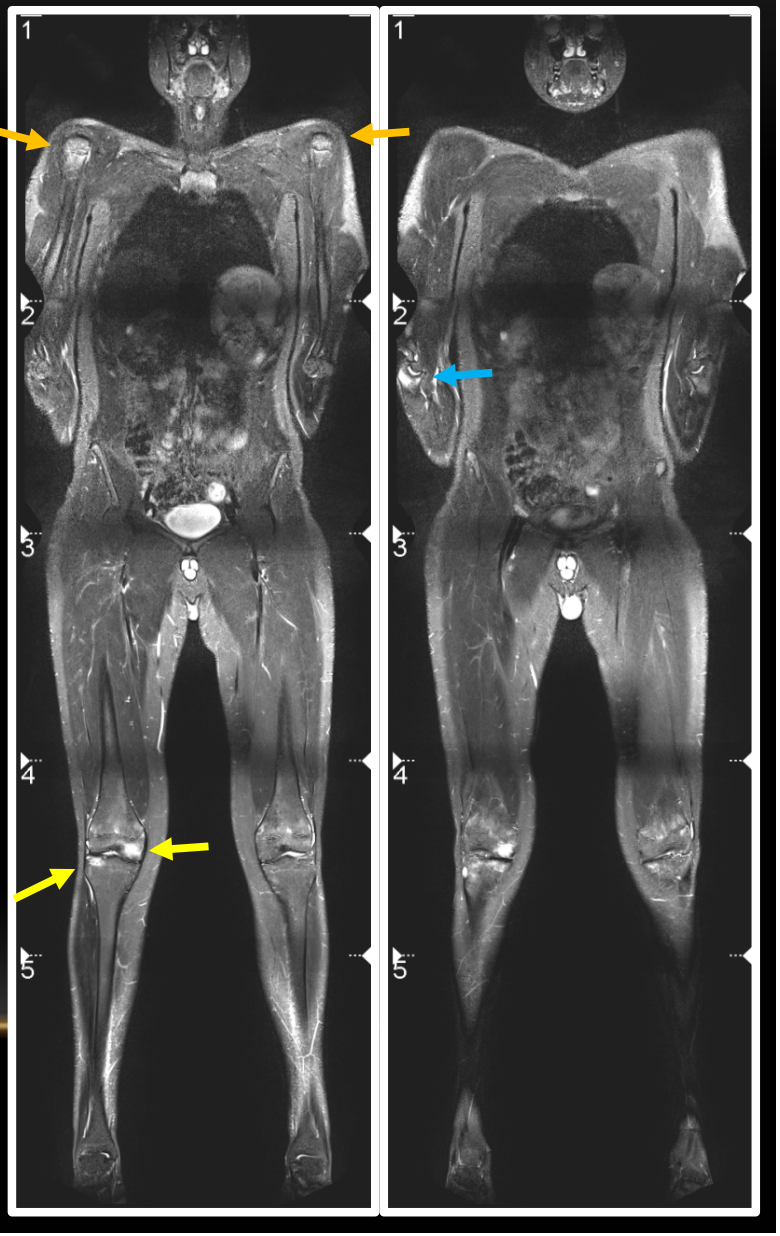
CASE 1: 16 YO M WITH LEFT KNEE PAIN

- Initial knee MRI reveals subtle STIR hyperintensities adjacent to the growth plates

CASE 1: 16 YO M WITH LEFT KNEE PAIN (CONT'D)

- Initial knee MRI reveals subtle STIR hyperintensities adjacent to the growth plates

- Whole body MRI at the time of initial diagnosis reveals non-symptomatic disease in the right knee, right olecranon as well as the bilateral humeral heads



CASE 1: 16 YO M WITH LEFT KNEE PAIN (CONT'D)

- 1 year follow up MRI reveals increased size and intensity of STIR signal abnormalities in the left knee, consistent with worsening disease

Initial

1 year follow up

WHY WHOLE BODY MRI?

- Whole body MRI is an important tool for CRMO for several reasons:
  - Helps make the difficult diagnosis of CRMO (while hopefully avoiding unnecessary procedures such as biopsies)
  - Identifies symptomatically occult disease
  - Important for disease monitoring and treatment decisions

- Why create a CRMO specific whole body protocol?
  - To get full body coverage with full sequence focal MRIs can take up to 4 hours
  - Many sequences are not necessary for CRMO evaluation

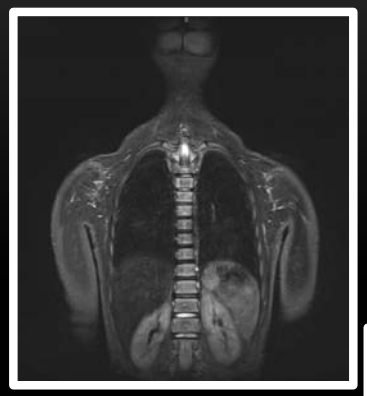
GOALS OF CREATING A WHOLE BODY MRI CRMO SCREENING PROTOCOL

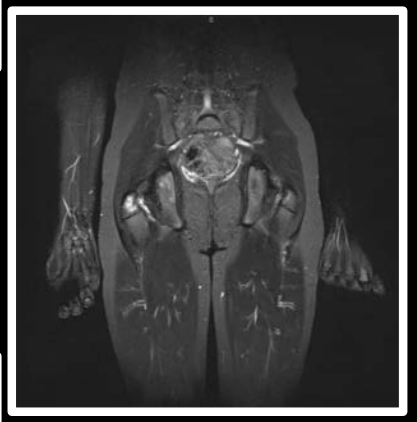
- Minimize scan time
  - Scan must be short enough that children can tolerate without sedation
  - This should be a screening exam to identify severity and symptomatically occult disease
    - If there are areas of question, these areas can be more completely evaluated with a focused MRI exam

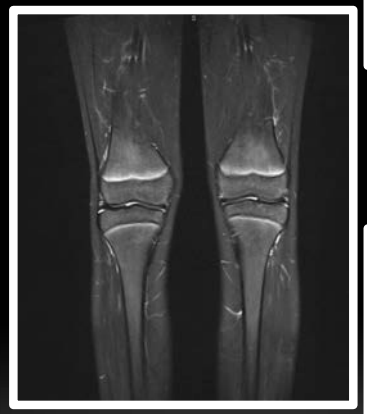
- Maximize diagnostic information
  - STIR sequences are very sensitive for marrow edema which is one of the earliest and most consistent findings in CRMO

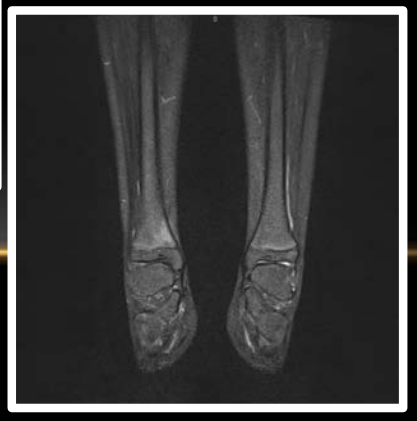
INITIAL WHOLE BODY CRMO PROTOCOL

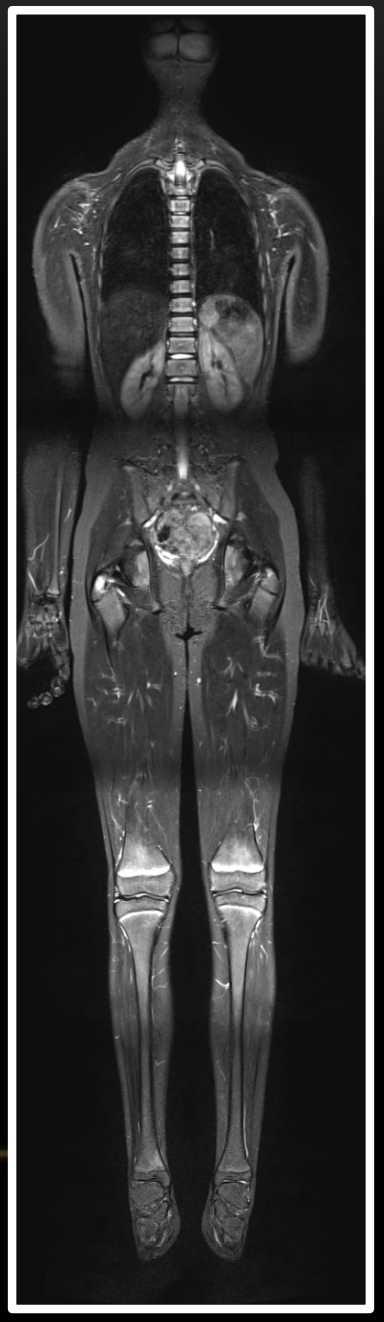
- Coronal 3D STIR whole body only
  - Performed in 4-5 stations
    - Depending on height
  - Stitched together
    - Using Seimens Composer Application





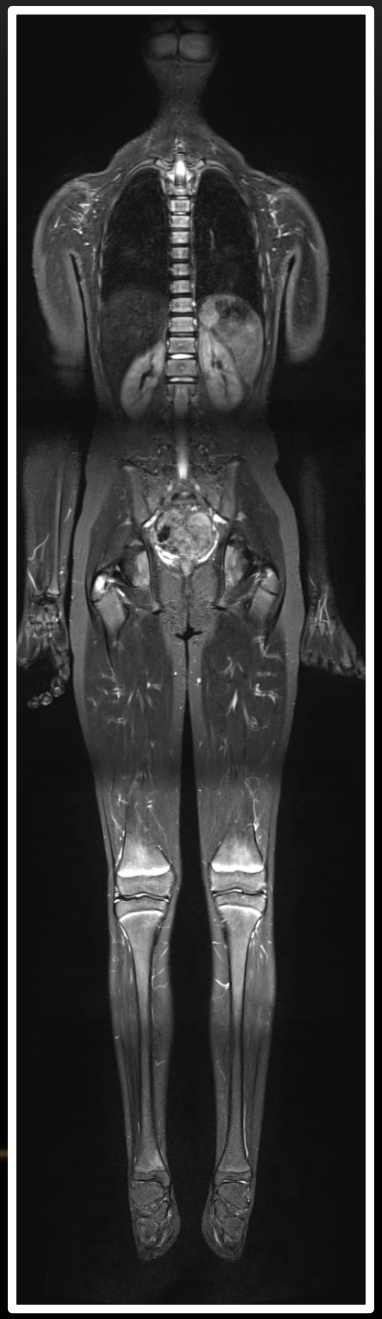






INITIAL WHOLE BODY CRMO PROTOCOL

- Pros:
  - Very fast (15-20 min)
- Cons:
  - Some areas are difficult to evaluate with only the coronal plane
    - Because some areas were difficult to localize, more call backs were made for focused exams



AREAS THAT ARE DIFFICULT TO EVALUATE WITH ONLY CORONAL IMAGES

- Can be difficult to count vertebral bodies on coronal images due to plane

- In coronal whole body imaging, feet are often in a non-orthogonal plane to the body, making localization difficult

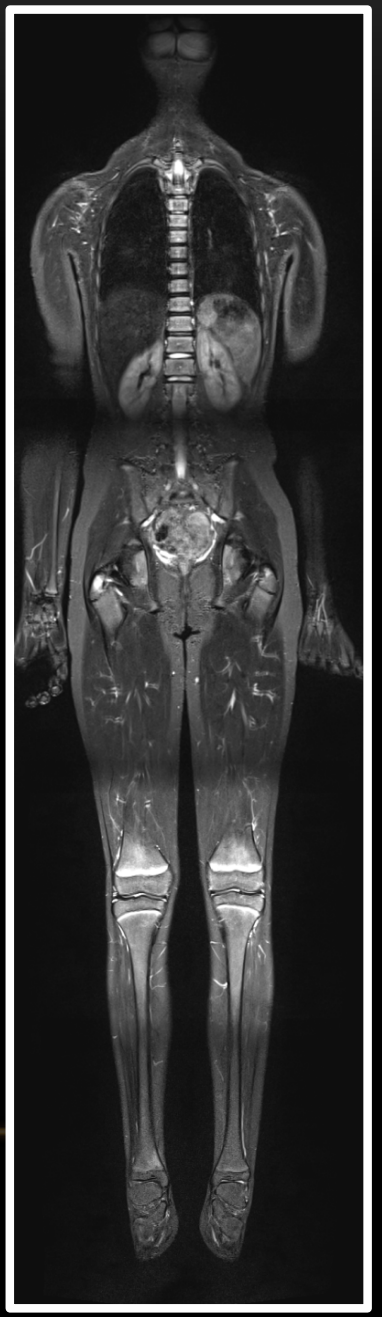
AREAS THAT ARE DIFFICULT TO EVALUATE WITH ONLY CORONAL IMAGES

- Can be difficult to count vertebral bodies on coronal images due to plane
- Much easier to localize spinal lesions in the sagittal plane

- In coronal whole body imaging, feet are often in a non-orthogonal plane to the body, making localization difficult
- Sagittal images make localization of this lesion in the cuboid much easier

IMPROVED WHOLE BODY CRMO PROTOCOL

- Coronal 3D STIR Whole body
  - In 4-5 stations and stitched together
- Sagittal 3D STIR of the spine
  - In 2 stations (C-T spine and T-L spine)
- Axial 3D STIR of the pelvis
  - To improve localization
- Axial 3D STIR of the bilateral knees
  - Most common site of involvement
- Sagittal 3D STIR of the ankles
  - Often involved, can be difficult to localize on coronal due to positioning



IMPROVED CRMO PROTOCOL: TIME

Sequence	Time per sequence (min)	Total time per sequence(min)
Coronal 3D STIR Whole body	1:37-2:08 x 4-5 stations	6:28-10:40
Sagittal spine 3D STIR	1:46 x 2 stations	3:32
Axial pelvis 3D STIR	2:56	2:56
Axial knees (both together)	2:30	2:30
Ankles/Feet (each side)	1:46 x two sides	3:32
Total scan time		**18:58 - 23:10**

OUR IMPROVED CRMO PROTOCOL

- Pros:
  - Relatively fast. Full exam can be performed in a 40 min time slot
  - No single acquisition is longer than 3 min
  - Commonly involved areas have more dedicated imaging (pelvis, knees, feet)

- Cons:
  - Depending on height, entire calvarium is often not included (rare site of involvement)
  - Hands may not be completely included on exam (uncommon site of involvement)

BILLING FOR WHOLE BODY CRMO MRI

- There is currently **no CPT for whole body MRI**

- CPT 76498: Unlisted CPT code
  - This CPT code is often automatically denied by insurance because of its lack of specificity

- It is important to petition the AMA to create a CPT code for whole body MRI
  - Whole body MRIs are an essential imaging tool for screening systemic disease processes as CRMO and Li Fraumeni syndrome
  - Currently it can be very difficult to get preauthorization for these exams due to lack of CPT code

- PLEASE PETITION THE AMA FOR A CPT CODE FOR WHOLE BODY MRI

BILLING FOR WHOLE BODY CRMO MRI

- * This is how our institution bills for these whole body CRMO MRIs*
  - This is not a suggestion on how your institution should bill for CRMO whole body MRIs
  - This is just letting you know how we handle it at our institution
- For our whole body CRMO MRIs
  - CPT 72915: MR Pelvis without contrast
  - CPT 72148: MR Lumbar spine without contrast
- At our institution we have had much less difficulty getting preauthorization using these CPT codes than the unlisted CPT 76498

OUR EXPERIENCE WITH CRMO WHOLE BODY MRIS

- We have used our improved CRMO whole body MRI protocol for over 2.5 years
- We have done 100+ studies using this protocol
- Our clinicians are very happy with our images and the information we collect from these images
- As a referral center for CRMO, we see many external exams with a variety of imaging protocols for evaluation of CRMO
    - We feel that our whole body CRMO protocol maximizes the diagnostic information for these patients while minimizing scan time

WHOLE BODY CRMO MRI: SUMMARY

- Chronic Recurrent Multifocal Osteomyelitis (CRMO) is an inflammatory disease characterized by a sterile inflammatory lesions in multiple sites with a waxing and waning course

- Whole body MRI is an important tool for evaluating these patients to find non-symptomatic disease, as well as to assess treatment

- We describe a high yield whole body MRI protocol that can be done within 40 min (25 min scanning)

- There is currently no CPT code for whole body MRI
  - It will be important to get a CPT code for whole body MRI to streamline to process of ordering (and getting preauthorization for) a whole body MRI

THANK YOU VERY MUCH

Questions/comments: shawn-sato@uiowa.edu