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## ABSTRACT

**Background:**  
Early recognition of deep seated infections (osteomyelitis and abscesses) in the pediatric population may be difficult, given nonspecific symptoms and signs, but remains crucial in the management. There is increasing emphasis on ionizing radiation dose reduction, making whole-body MRI (WBMRI) with short TI inversion recovery (STIR) the advanced imaging modality of choice over bone scintigraphy/CT-scans.

**Methods:**  
A retrospective chart review of pediatric patients, <19 years, at Palmetto Health, Columbia, SC who had WBMRI with infectious indications during 9/2011 to 12/2013 was performed. The aims of this research were to describe complications related to sedation/contrast, to determine what portion of patients had new evidence of deep seated infections and to obtain initial evidence for effectiveness of WBMRI.

**Results:**  
20 patients were included with male predominance (12; 60%). 9/20 patients < 12 months old and 4 between the ages of 12-70 months. The most common comorbidity was sickle cell syndrome (n=6) and 16/20 patients had a recent/current central venous catheter. The reasons for imaging were fever (9, 45%), pain/swelling (5, 25%), and abnormal labs/imaging (6, 30%). 19 patients had other diagnostics studies prior to WBMRI, 17 of whom had ionizing radiation using studies (X-rays / CT scans). 9/19 also had additional trips to the radiology department for focal MRIs. Duration of sedation for WBMRI averaged 88 minutes, with propofol (10/14) being the most common agent used. No complications from the sedation or the MRI contrast were recorded. WBMRI found an average of 1-4 areas of osteomyelitis in 12 patients and up to 8 other locations of deep seated infections in 15 patients. 11/20 had post WBMRI surgical intervention of debridement/drainage. Gram-positive cocci were isolated from 10/17 patients with positive blood/tissue cultures. Of those, 6 were MRSA.

**Conclusion:**  
Utilized as an early imaging modality in pediatric patients with persistent bacteremia/fevers, WBMRI commonly facilitated timely definitive interventions while sparing the patient exposure to ionizing radiation. WBMRI with STIR was safe and is likely to be cost effective.

## INTRODUCTION

- Osteomyelitis is often a complication of bacteremia and it has been linked to developing permanent disability and fatalities if unrecognized in the pediatric population. Early recognition of infection and rapid initiation of therapy is important to avoid the sequelae<sup>1,3,4</sup>
- Bone <sup>99m</sup>Tc scintigraphy, CT scan, and x-ray are all routinely used to diagnose multiple sites of bone infection, with bone <sup>99m</sup>Tc scintigraphy currently being the standard of care in locating deep seated infection in patients who have failed antimicrobial therapy. These modalities expose patients to high amounts of ionizing radiation which potentially increases cancer risk<sup>2,5</sup>
- Whole Body MRI(WBMRI), which has no radiation exposure, has been found to be effective in the detection of inflammatory arthritis, metastatic lesions and asymptomatic inflammatory bone changes that were not seen on radiographs/bone scan<sup>6,7</sup>
- However the risks associated with sedation during MRI imaging such as hypoxia and failed sedation remain a concern

## OBJECTIVES

- To describe the characteristics of patients who had WBMRI
- To determine what percentage of patients had evidence of: uni-focal osteomyelitis (OM), multifocal OM, or another type of infection (i.e. abscess) on the WBMRI
- To describe the causative organisms isolated
- To describe complications related to sedation used for WBMRI

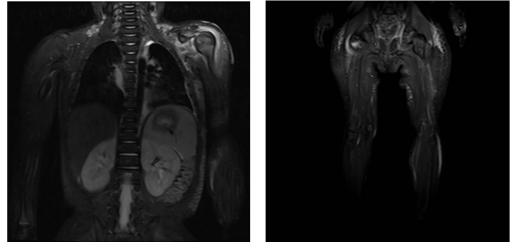
## METHODS

- Retrospective chart review of pediatric patients at Palmetto Health, Columbia, South Carolina from 9/2011-12/2013
- Inclusion criteria:
  - WBMRI obtained for infectious etiology
  - Age <19 years old
- Exclusion criteria: WBMRI for noninfectious reasons

## RESULTS

- Clinical characteristics of the 20 patients are summarized in Table 1.
- WBMRI findings included unifocal OM, multifocal OM, and other of deep seated infections (Figures 1 and 2).
- WBMRI found an average of 1-4 areas of OM in 12 patients and up to 8 other locations of deep seated infections in 15 patients.(Figure 3)

**Figure 1:WBMRI images from a patient demonstrating articular and peri-articular changes involving the left shoulder & OM involving the proximal right femur**

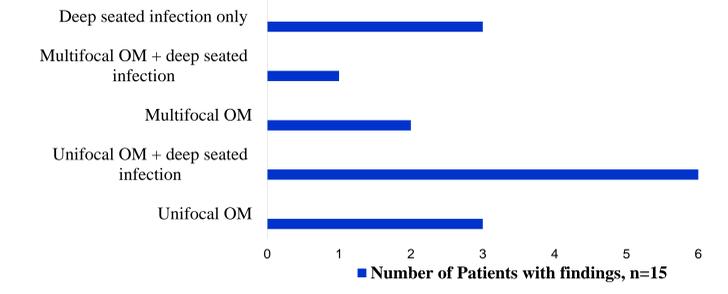


**Table 1: Baseline characteristics of patients**

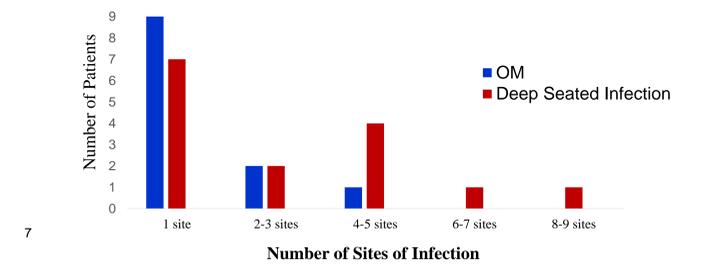
Characteristic	n =20
Demographics	
Age, n (%)	
<12 months	9 (45%)
12- 70 months	4 (20%)
Male gender, n (%)	12 (60%)
Comorbidities, n (%)	
Sickle cell syndrome	6 (30%)
Diabetes Mellitus	1 (5%)
Chronic Kidney Disease	1 (5%)
Symptoms, n (%)	
Fever	9 (45%)
Abnormal labs/imaging	6 (30%)
Pain/swelling	5 (25%)
Labs (mean)	
WBC	15 K/uL
CRP	93 mg/L
ESR	67 mm/hr
Risk Factors, n (%)	
Recent/current Central Venous Catheter	16 (80%)
Prior osteomyelitis	4 (20%)
Prior soft tissue infection	2 (10%)
Prior bacteremia	1 (5%)

## RESULTS

**Figure 2: Findings on WBMRI**



**Figure 3: Number of Sites of OM and Deep Seated Infections**

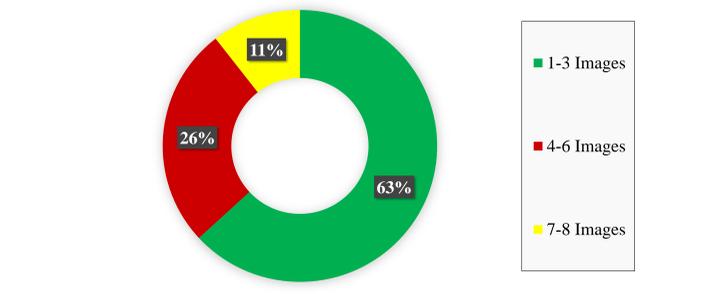


## RESULTS

- Additional imaging**
- 19 (95%) patients had additional imaging prior to their WBMRI, 17 of whom had exposure to ionizing radiation (X-rays and CT scans)
  - 37% of patients had 4-8 additional images as part of infectious workup (Figure 4).
  - 9 of these 19 patients also had additional transport to the radiology departments for focal MRIs

- WBMRI related events**
- No reactions to contrast or complications from sedation were reported (Table 2)

**Figure 4: Number of Additional Images Required as Part of Infectious Workup**

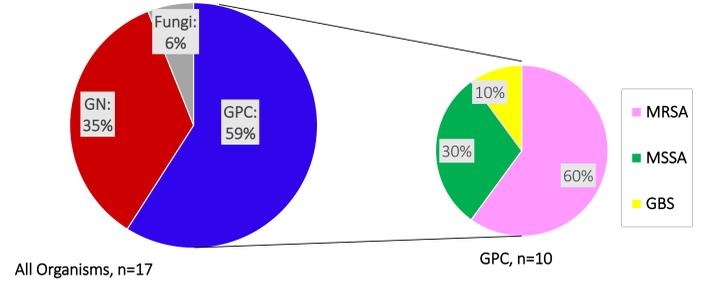


## RESULTS

- Outcome post WBMRI**
- 11/20 patients had additional intervention (surgical debridement/drainage) based on the findings of the WBMRI

- Organisms isolated**
- 17/20 patients had positive blood and/or tissue cultures
  - Majority of the organisms isolated were gram positive cocci(GPC) (n=10, 59%) (Figure 5)
    - Of these, the majority were *Staphylococcus aureus* (SA) (9/10, 90%) of which 6 were methicillin resistant SA

**Figure 5: Organisms isolated**



**Table 2: Safety and Adverse Events**

Characteristic	N=20
Contrast	
Contrast Used (n, %)	9 (45%)
Reaction to Contrast (n, %)	0 (0%)
Sedation	
Sedation Used (n, %)	14 (70%)
- Propofol for sedation (n, %)	10 (71%)
Average length of Sedation (min)	88.4
Complications from sedation (n, %)	0 (0%)

## CONCLUSION

- WBMRI as an early imaging modality in pediatric patients with persistent bacteremia/fevers, commonly facilitated timely definitive interventions while sparing the patient exposure to ionizing radiation
- WBMRI with STIR was safe and is likely to be cost effective
- Data collection is ongoing

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