

history of the infectious process rather than evidence of deterioration if the child is clinically improving.

Rationale for Recommendation

Although the sensitivity of plain radiographs for the diagnosis of AHO is low, their value both in narrowing the differential diagnosis and as potential baseline studies outweighs the concern around the high false-negative rate for AHO. Because the overall benefits exceed risks, the panel thus makes a strong recommendation that plain radiographs remain a routine part of the evaluation of children with suspected AHO.

Advanced Imaging: MRI, Scintigraphy, CT, and US

Advanced imaging is often necessary to more definitively establish the presence of AHO or more precisely define the extent of infection in and around the infected bone as well as rule out other noninfectious processes. MRI, bone scintigraphy, CT, and US have all been used for these purposes and have varying potential roles in the diagnosis and management of AHO (see also XII).

Diagnostic Test Accuracy for the Diagnosis of AHO

Summary of the Evidence

Our systematic review of the literature identified a total of 12 studies published between 2005 and 2019 reporting on the diagnostic test accuracy of one or more advanced imaging studies for the diagnosis of AHO [4, 7, 44, 45, 57, 77, 96, 98–102]. Sensitivity of MRI for the diagnosis of AHO ranged from 81% to 100% in 8 studies [4, 44, 45, 77, 96, 98–100] and specificity ranged from 67% to 94% in 5 studies [4, 96, 98–100]. MRI with gadolinium contrast administration has slightly better sensitivity than MRI without contrast [98, 99, 102]. Positive predictive values ranged from 80% to 93% [4, 96, 99] but may be somewhat lower in children with sickle cell disease (76% in a single study) [100]. Sensitivity of bone scintigraphy ranged from 30% to 91% in 6 studies [4, 7, 44,

57, 77, 96], whereas specificity was reported to be 47% and 84% in 2 of these studies [4, 96]. Data regarding the accuracy of CT and US for the diagnosis of AHO in children are more limited in terms of sample size and number of studies. The diagnostic test accuracy of CT was reported in only 2 studies: sensitivity was 67% to 100% [44, 96] and specificity was 50% in 1 of the 2 studies [96]. Lastly, sensitivity of US varied from 17% to 76% in 4 studies [44, 45, 96, 101], and specificity was reported to be 47% and 91% in 2 studies [96, 101]. The wide variation observed in diagnostic test accuracy of the different imaging modalities may have resulted from differences in population selection (suspected vs confirmed AHO and AHO caused by various bacteria vs restricted to *S. aureus* only), in the timing of each imaging study, in the reference standard (MRI only vs extended reference standard including multiple tests), and from potential verification bias (not all patients received the same tests in all studies).

Of these 13 studies initially identified through our systematic review of the literature, 5 studies directly comparing the diagnostic accuracy of MRI with other imaging modalities in the same cohort of patients suspected of AHO (see Table 2). Among 4 recent studies evaluating MRI and technetium-99 3-phase scintigraphy (bone scan), the comparative sensitivity ranged from 81% to 100% for MRI and from 53 to 91% for scintigraphy [4, 44, 77, 96], and the comparative specificity was 67% to 94% for MRI and 47% to 84% for scintigraphy [4, 96]. Similar results were seen in 2 older studies [103, 104]. Based on these reviewed studies, the committee concluded that MRI has better overall diagnostic test accuracy than bone scintigraphy for the diagnosis of AHO.

Similarly, among 2 studies evaluating the accuracy of MRI and CT, comparative sensitivity ranged from 81% to 100% for MRI and from 67% to 100% for CT [44, 96]; comparative specificity was 67% for MRI and 50% for CT [96]. These 2 studies were judged imprecise due to the small sample size. However, an older study of a slightly larger patient cohort showed similar

Table 2. Comparative Diagnostic Accuracy of Different Imaging Modalities vs Magnetic Resonance Imaging (MRI) in Children With Suspected Acute Hematogenous Osteomyelitis (AHO)^a

	N	Sensitivity (95% CI)	Specificity (95% CI)
MRI vs bone scintigraphy			
MRI	343	81% (64-93) to 100% (90-100) [4, 44, 77, 96]	67% (22-96) to 94% (86-98) [4, 96]
Bone scintigraphy	236	53% (38-67) to 91% (80-97) [4, 44, 77, 96]	47% (31-64) to 84% (60-97) [4, 96]
MRI vs CT scan			
MRI	57	81% (64-93) to 100% (82-100) [44, 96]	67% (22-96)[96]
CT scan	25	67% (38-88) to 100% (63-100) [44, 96]	50% (1-98)[96]
MRI vs ultrasonography			
MRI	95	81% (64-93) to 100% (91-100) [44, 45, 96]	67% (22-96)[96]
Ultrasonography	177	17% (9-28) to 60% (41-77) [44, 45, 96]	47% (24-70)[96]

Abbreviations: CI, confidence interval; CT, computerized tomographic; MRI, magnetic resonance imaging.

^aRanges of diagnostic test accuracy results were presented due to the small number of studies included in the analysis. Furthermore, missing information on absolute number of patients receiving the index tests according to the final diagnosis in the Malcus study precluded pooling of sensitivity and specificity. Various sources of heterogeneity between studies (eg, presence of verification bias, ie, not all tests were performed in all patients, or significant difference of timing between tests) and variation in reference standard (based on MRI or other criteria) further impeded any meaningful interpretation of pooled results [4, 44, 45, 77, 96].