

Supplementary Appendix C: Clinical Scenarios used to develop ACR MSUS Appropriateness Criteria

Undiagnosed Arthritis
For a patient presenting with undiagnosed mono-articular pain and/or swelling, or mechanical symptoms whose etiology is uncertain, it is appropriate to perform MSUS of that joint to further elucidate the diagnosis.
For a patient presenting with undiagnosed oligo-articular pain and/or swelling, or mechanical symptoms whose etiology is uncertain, it is appropriate to perform MSUS of those joints to further elucidate the diagnosis.
For a patient presenting with undiagnosed polyarticular pain and/or swelling, (or mechanical symptoms) whose etiology is uncertain, it is appropriate to perform MSUS of those joints to further elucidate the diagnosis.
For a patient presenting with undiagnosed articular pain but no overt clinical signs, it is appropriate to perform MSUS of that joint to further elucidate the diagnosis.
In a patient with new onset undiagnosed mono- or oligo-arthritis, it is appropriate to scan targeted asymptomatic joints or regions for evidence of subclinical inflammatory arthritis or enthesitis.
In a patient with history of undiagnosed mono- or oligoarthralgia suggestive of inflammatory arthritis (currently asymptomatic), it is appropriate to scan that (those) joint(s) for evidence of inflammatory changes or crystals.

Diagnosed Arthritis
MSUS is an appropriate modality to evaluate those joints for persistent inflammatory disease activity.
For a patient presenting with diagnosed inflammatory arthritis* and ongoing articular pain, swelling, or mechanical symptoms, MSUS is an appropriate modality to evaluate for structural damage or progression.
For a patient presenting with diagnosed inflammatory arthritis and a new site of articular pain, swelling, or mechanical symptoms MSUS is an appropriate modality to evaluate for emergence of inflammatory disease activity at that site.
For a patient presenting with diagnosed inflammatory arthritis* and new articular pain, swelling, or mechanical symptoms MSUS is an appropriate modality to evaluate for emergence of an alternate cause of symptoms at that site.
For a patient presenting with diagnosed inflammatory arthritis* and who is now asymptomatic or with minimal symptoms, MSUS is an appropriate modality to evaluate for persistent inflammatory disease activity.
For a patient presenting with diagnosed inflammatory arthritis* and who is now asymptomatic or with minimal symptoms, MSUS is an appropriate modality to evaluate for structural progression.

*Inflammatory arthritis was defined as including but not limited to rheumatoid arthritis, seronegative spondylarthropathies, SLE, MCTD/overlaps, adult onset Still's disease, infectious arthritis, crystalline arthritis and JIA.

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Hip
For a patient presenting with undiagnosed pain of the hip region, MSUS is an appropriate diagnostic modality to evaluate for hip effusion.
For a patient presenting with undiagnosed pain of the hip region, MSUS is an appropriate diagnostic modality to evaluate for periarticular lesions.
For a patient presenting with undiagnosed locking or mechanical symptoms of the hip joint, MSUS is an appropriate diagnostic modality to evaluate for intra-articular and periarticular lesions.
For a patient presenting with undiagnosed catching symptoms of the hip joint (snapping hip), MSUS is an appropriate diagnostic modality because it allows dynamic visualization of supporting and regional soft tissue structures, thereby identifying abnormal tendon and ligament motion.

Regional
For a patient presenting with spontaneous painful/painless regional (non-articular) swelling, MSUS is an appropriate procedure to determine the pathological basis of the swelling.
For a patient presenting with spontaneous regional musculoskeletal pain, with or without clear localization on clinical examination, MSUS is an appropriate procedure to evaluate regional structures as potential causes of pain.
For a patient presenting with spontaneous regional mechanical symptoms (crepitus/clicking/snapping/impingement), with or without clear localization on clinical examination, MSUS is an appropriate procedure to evaluate regional structures for potential causes of these symptoms.
For a patient with contractures and tightening of the forearms, MSUS is an appropriate procedure to differentiate eosinophilic fasciitis from systemic sclerosis.
For a patient with symptoms and signs suggestive of giant cell arteritis (GCA), MSUS of the temporal arteries is an appropriate procedure for a patient being evaluated for GCA.
MSUS of the parotid/submandibular glands is an appropriate procedure for a patient being evaluated for Sjögren's to determine whether they have typical changes as further evidence of the disorder.
MSUS is an appropriate procedure for a patient being evaluated for muscle weakness.

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Periarticular
For a patient presenting with undiagnosed periarticular pain and swelling, MSUS is an appropriate diagnostic modality to evaluate the nature of the swelling (cystic vs. solid) and its relation to surrounding tissues.
For a patient presenting with undiagnosed pain and/or swelling in or around a joint that cannot be clinically characterized, MSUS is an appropriate diagnostic modality to localize the swelling (articular vs. peri-articular).
For a patient presenting with undiagnosed periarticular pain and no swelling, MSUS is an appropriate diagnostic modality to evaluate tendon and soft tissue pathologies as a cause of that pain.**

**Structural abnormalities that can be detected / measured using MSUS

1. Effusion
2. Synovitis
3. Synovial thickening
4. Tenosynovitis
5. Popliteal cysts
6. Osteoarthritis changes
7. Damage to fibrocartilaginous structures
 - a. Knee meniscus
 - b. Wrist meniscus
 - c. Shoulder labrum
 - d. Hip joint labrum
 - e. Loose bodies
8. Crystal disorders
 - a. Chondrocalcinosis
 - b. Double contour sign (a hyperechoic, irregular band over the superficial margin of the articular cartilage is described as a double contour sign)
 - c. Periarticular tophi
 - d. Tendon tophi
9. Cystic vs. solid swelling
10. Tophi
11. Rheumatoid nodules
12. Ligamentous tear
13. Tendonopathy
14. Tendon tear
15. Tendon subluxation
16. Tendon impingement
17. Tendon calcification
18. Bursitis
19. Plantar fasciitis
20. Palmar fasciitis
21. Median nerve at carpal tunnel
22. Median nerve at forearm
23. Radial nerve at forearm
24. Ulnar nerve at Guyon's canal
25. Ulnar nerve at Cubital tunnel
26. Peroneal nerve at fibular head
27. Posterior tibial nerve at tarsal tunnel
28. Interdigital nerves – Morton's neuroma

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Entheses

For a patient presenting with enthesal pain or swelling, MSUS is an appropriate procedure to investigate a patient's entheses to detect sonographic signs of enthesopathy (e.g., enthesis erosions, tendon abnormality, bursal changes and hyperemia demonstrated by doppler).

For a patient presenting with inflammatory sounding sacro-iliac or spine pain, MSUS is an appropriate procedure to detect enthesal changes at other regional sites that are indicative of spondyloarthritis, thus aiding the diagnostic process.

Shoulder

For a patient presenting with shoulder pain or mechanical symptoms, MSUS is an appropriate diagnostic modality to diagnose the underlying structural cause.

For a patient presenting with reduction in shoulder ROM, MSUS is an appropriate procedure to diagnose the underlying structural cause.

For a patient presenting with shoulder pain and clinical signs of impingement, and/or for a patient with mild reduction in ROM, MSUS is an appropriate procedure to diagnose the underlying structural cause.

For a patient presenting with internal derangement of the shoulder joint, MSUS is not an appropriate procedure to definitively evaluate the articular and periarticular structures of the shoulder joint as preparation for surgical intervention because certain structures are not visible on MSUS.

Miscellaneous

For a patient presenting with undiagnosed articular pain, swelling, or mechanical symptoms of a joint whose clinical signs are obscured by adipose tissue or other local derangements of soft tissue, MSUS is an appropriate diagnostic modality for evaluation because detection of articular lesions is not significantly impeded by overlying adiposity or soft tissue derangements.

For a patient with symptoms and signs suggestive of giant cell arteritis (GCA), MSUS of the temporal arteries is an appropriate procedure for a patient being evaluated for GCA.

MSUS of the parotid/submandibular glands is an appropriate procedure for a patient being evaluated for Sjögren's to determine whether they have typical changes as further evidence of the disorder.

MSUS is an appropriate procedure for a patient being evaluated for muscle weakness.

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Nerve
For a patient with regional neuropathic pain without definitive diagnosis on clinical exam, MSUS is an appropriate procedure to evaluate and diagnose a nerve entrapment.
For a patient with a clinical diagnosis of nerve entrapment on clinical exam, MSUS is an appropriate procedure to confirm the diagnosis and the site of entrapment.
For a patient with a clinical diagnosis of nerve entrapment on clinical exam, MSUS is an appropriate procedure to evaluate the severity of the disorder for therapeutic stratification.

Procedure Guidance
MSUS is appropriate for guidance during aspiration of a fluid collection and clinical suspicion for synovial/tenosynovial/bursal effusion.
MSUS is appropriate for guidance during aspiration of a fluid collection and clinical diagnosis of synovial/tenosynovial/bursal effusion when the localization of that fluid is not clinically definite.
MSUS is appropriate for guidance during aspiration of a fluid collection and clinical suspicion for non-synovial fluid collection (abscess, cyst).
MSUS is appropriate for guidance during aspiration of a fluid collection and clinical diagnosis of non-synovial fluid collection (abscess, cyst), when the localization of that fluid is not clinically definite.
MSUS is appropriate for guidance during fine needle aspiration of a suspected tophaceous mass.
MSUS is appropriate for guidance during fine needle aspiration of a suspected tophaceous mass when the localization is not clinically definite.
MSUS is appropriate for guidance during needle tenotomy procedures.
MSUS is appropriate for guidance during barbotage/removal/aspiration of calcium deposit.
MSUS is appropriate for guidance during percutaneous needle resection of soft tissue structures.
MSUS is appropriate for guidance during injection of medications or other therapies into synovial/tenosynovial/bursal structures.
MSUS is appropriate for guidance during injection of medications or other therapies into synovial/tenosynovial/bursal structures, when the localization of these structures is not clinically definite.
MSUS is appropriate for guidance during injection of medications or other therapies into non-synovial structures.
MSUS is appropriate for guidance during injection of medications or other therapies into non-synovial structures,

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when the localization of these structures is not clinically definite.
MSUS is appropriate for guidance during peritendon injection of medications or other therapies.
MSUS is appropriate for guidance during peritendon injection of medications or other therapies, when the localization of these structures is not clinically definite.
MSUS is appropriate for guidance during perienthesial injection of medications or other therapies.
MSUS is appropriate for guidance during perienthesial injection of medications or other therapies, when the localization of these structures is not clinically definite.
MSUS is appropriate for guidance during perineural injection of medications or other therapies.
MSUS is appropriate for guidance during perineural injection of medications or other therapies, when the localization of these structures is not clinically definite.
MSUS is appropriate for guidance during nerve block/ablation.
MSUS is appropriate for guidance during nerve block/ablation, when the localization of these structures is not clinically definite.
MSUS is appropriate for guidance during synovial biopsy procedures (includes MSK sites adequately visualized by ultrasound scanner).
MSUS is appropriate for guidance during foreign body removal procedures (includes MSK sites adequately visualized by ultrasound scanner).

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Outcome Measurement
MSUS is appropriate for monitoring disease activity and progression in patients with inflammatory polyarthritis (refer to features in section A of MSUS Modalities table below).*
MSUS is appropriate for evaluating structural outcomes in patients with osteoarthritis (refer to features in section B of MSUS Modalities table below).

*Inflammatory arthritis was defined as including but not limited to rheumatoid arthritis, seronegative spondylarthropathies, SLE, MCTD/overlaps, adult onset Still’s disease, infectious arthritis, crystalline arthritis and JIA.

MSUS Modalities	
<i>Section A: MSUS for inflammatory lesions</i>	Joint effusion: B mode imaging
	Synovial hypertrophy: B mode imaging
	Synovial hyperemia: Power Doppler imaging
	Erosions: B mode and power Doppler imaging
	Cartilage thinning: B mode imaging
	Crystal deposition: B mode imaging
	Intraarticular tophi: B mode imaging
<i>Section B: MSUS for non-inflammatory articular derangement</i>	Joint effusion: B mode imaging
	Loose bodies: B mode imaging
	Articular osseous cortical irregularities: B mode imaging
	Articular cartilaginous irregularities: B mode imaging
	Lesions in supporting soft tissues (tendinopathy, tendon and ligament disruption): B mode imaging

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Nonarticular MSUS Modalities
Tenosynovitis: B mode and Doppler imaging
Cysts: B mode and Doppler imaging
Tophi: B mode and Doppler imaging
Rheumatoid nodules: B mode and Doppler imaging
Tendinopathy or disruption: B mode imaging
Tendon impingement: B mode imaging
Tendon subluxation: B mode imaging
Tendon calcification: B mode imaging
Bursitis: B mode and Doppler imaging
Fasciitis: B mode and Doppler imaging
Non-articular osseous cortical irregularities: B mode imaging
Ligamentous disruption: B mode imaging