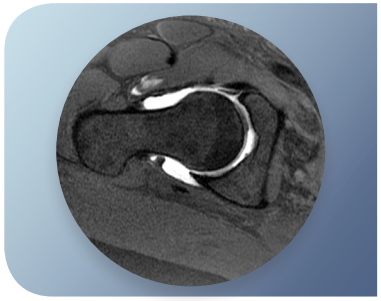


Intermountain Imaging Criteria:

Hip Pain

Through its Intermountain Imaging Criteria Project, Intermountain Healthcare has developed a suite of standardized care process models (CPMs) for the use of advanced imaging procedures in eight priority clinical areas. These evidence-based guidelines are intended to be widely implemented to improve patient safety, improve outcomes, and reduce unnecessary medical spending for the Medicare population and the U.S. health system overall.

Why Focus ON INTERMOUNTAIN IMAGING CRITERIA?

Advanced imaging procedures, including MRI, CT, PET, and nuclear medicine, facilitate rapid and accurate detection and/or diagnosis of disease. The volume of advanced imaging procedures prescribed to patients in the U.S. increased three- to four-fold from 1996–2010 as the technologies became widely available.[SMI] The inflating costs of advanced imaging outstripped that of any other medical service.[IGL, GAO] These inflating costs resulted in up to $20–30 billion in unnecessary advanced imaging spending each year.[NYDH]

- **High cost.** Although the spending growth in advanced imaging dropped off after the early 2000s, 2014 costs to Medicare Part B for advanced imaging exceeded $2.4 billion for common conditions alone.[LEV, CMS1]
- **Limited effectiveness.** Multiple studies suggest that up to a third of advanced imaging procedures fail to contribute to diagnosis or are clinically inappropriate.[NYDH]
- **Patient safety.** Advanced diagnostic imaging often exposes the patient to ionizing radiation and/or contrast media, posing additional medical risks that must be weighed against the potential benefits of the imaging procedure.
- **Overdiagnosis and overtreatment.** There is an unrecognized risk of overdiagnosis and subsequent overtreatment that carries associated risks (e.g., drug reactions or unnecessary surgical interventions) if advanced imaging is performed in patients with low pretest probability. The Intermountain Imaging Criteria approach seeks to avoid these risks.

WHAT'S INSIDE?

GOALS AND MEASURES

Indicates an Intermountain measure

This CPM was developed by Intermountain clinical experts to outline appropriate use criteria (AUC) for advanced imaging for hip pain. These guidelines, together with those for other priority clinical areas, will improve the quality of care provided to patients by:

- Increasing adherence to evidence-based AUC for the use of advanced imaging
- Reducing imaging tests that do not conform to AUC or for which there are no guidelines
- Decreasing system-wide spending on unnecessary advanced imaging services
- Reducing the risk of harm from unwarranted radiation exposure
- Documenting the incidence of a significant positive on advanced imaging tests and aligning with downstream care

OVERVIEW: INTERMOUNTAIN IMAGING CRITERIA APPROPRIATE USE CRITERIA CONTENT

Intermountain Imaging Criteria appropriate use criteria (AUC) support clinicians in providing evidence-based care to the patients they serve. Although appropriate use of Intermountain Imaging Criteria fulfills compliance requirements under PAMA, patients will only fully benefit from their use as they are deployed within the framework of a locally driven quality improvement program. To learn more about Intermountain's process for developing and maintaining AUC, visit: https://intermountainhealthcare.org/services/imaging-services/intermountain-imaging-criteria/.

The care process model approach

Designed as care process models (CPMs), the Intermountain Imaging Criteria AUC content is a blueprint that logically guides the delivery of evidence-based care via an algorithmic visual presentation (see list at right and pages 5 through 22). Although these Intermountain Imaging Criteria CPMs specifically focus on the appropriate use of advanced imaging, they can be viewed as portions of broader CPMs that guide not only diagnostic but therapeutic interventions for a specific disease or condition.

Ideally, Intermountain Imaging Criteria CPMs are engaged early in the patient encounter and guide the various considerations that lead to the ultimate decision regarding the ordering of an imaging study. Point-of-order checklists are also included in the CPMs (beginning on page 23). These checklist-based guidelines are logically equivalent to the algorithms from which they are derived.

Knowing that local factors will invariably impact decisions about selecting the most appropriate exam, Intermountain Imaging Criteria CPMs specify the generally preferred exam but also provide alternative choices that may be appropriate in certain clinical settings.

Relative imaging cost and radiation risk rankings

To further aid providers, each algorithm includes a ranking of relative costs and radiation risk for each advanced imaging test recommended. The cost scale is derived using global non-facility relative value units (RVUs) published by the Centers for Medicare and Medicaid Services (CMS) as a surrogate for cost.[CMS2] The radiation risk is derived from data published in 2010 by the Health Physics Society.[ACR, HPS]

Evidentiary review and ranking

Intermountain used the following two conceptual frameworks for evidentiary review of relevant literature:

1. The 2011 revision of the *Oxford Centre for Evidence-Based Medicine (OCEBM) 2011 Levels of Evidence* standard. This standard includes categorical leveling grades relevant to diagnostic studies and rates individual sources of evidence (published papers or other research data) on a five-point scale.[OCE]
2. The extensively used Fryback and Thornbury conceptual framework, which uses six levels for assessing the efficacy of diagnostic imaging.[FRY]

Each algorithmic presentation provides both rankings for the decision node (the pairing of AUC and recommended/alternative tests).

Using the algorithms and checklists

Under "Care Pathways" on page 3, there is an annotated algorithmic sample for a typical clinical scenario found in this CPM. Under "Point-of-Order Checklist" on page 4, there is an annotated sample of a typical point-of-order checklist for an imaging procedure recommended within the above sample algorithm.

HP ALGORITHMS

Abbreviations used in this CPM

AUC	= appropriate use content
AVN	= avascular necrosis
CPM	= care process model
CRP	= C-reactive protein
CT	= computed tomography
ER	= external rotation
ESR	= erythrocyte sedimentation rate
eGFR	= glomerular filtration rate
FABER	= flexion abduction and external rotation test
FADDIR	= flexion adduction and internal rotation test
IV	= intravenous
MARS	= metal artifact reduction sequences
MRI	= magnetic resonance imaging
PCP	= primary care provider
RVU	= relative value units
THA	= total hip arthroplasty
WBC	= white blood cells

Care pathways

For each clinical scenario (e.g., chronic hip pain plus proximal hamstring tendinopathy), there is an algorithmic presentation of the care pathway context for the imaging decisions made. This pathway contains not only the appropriate use criteria (AUC) and evidence-based advanced imaging recommendations but also what constitutes significant positive imaging results and downstream care recommendations. Note the elements of this presentation below and key information provided in each test recommendation box as shown at right. There is also a legend at the bottom of each care pathway page.

Algorithms are grouped as indicated on page 2.

See abbreviations on page 2.

The Arabic number in the green box indicates an evidence ranking derived from the OCEBM scale.[OCE] For this scale, the **lower** the number, the stronger the evidence ranking.

The Roman numeral in the orange box indicates an evidence ranking derived from the Fryback & Thornbury scale.[FRY] For this scale, the **higher** the number, the stronger the evidence ranking.

Cost rankings are indicated based on a range developed from the CMS Global Relative Value Units (RVUs) as follows:[CMS2]

$ = 0 – 5 RVUs
$$ = 5.01 – 10 RVUs
$$$ = 10.01 – 15 RVUs
$$$$ = 15.01+ RVUs

Radiation risk rankings use the scale developed by the American College of Radiology. This rating framework offers the following six levels for adult effective dose range risk:

R0 = 0 mSv
R1 = < 0.1 mSv
R2 = 0.1 – 1 mSv
R3 = 1 – 10 mSv
R4 = 10 – 30 mSv
R5 = 30 – 100 mSv

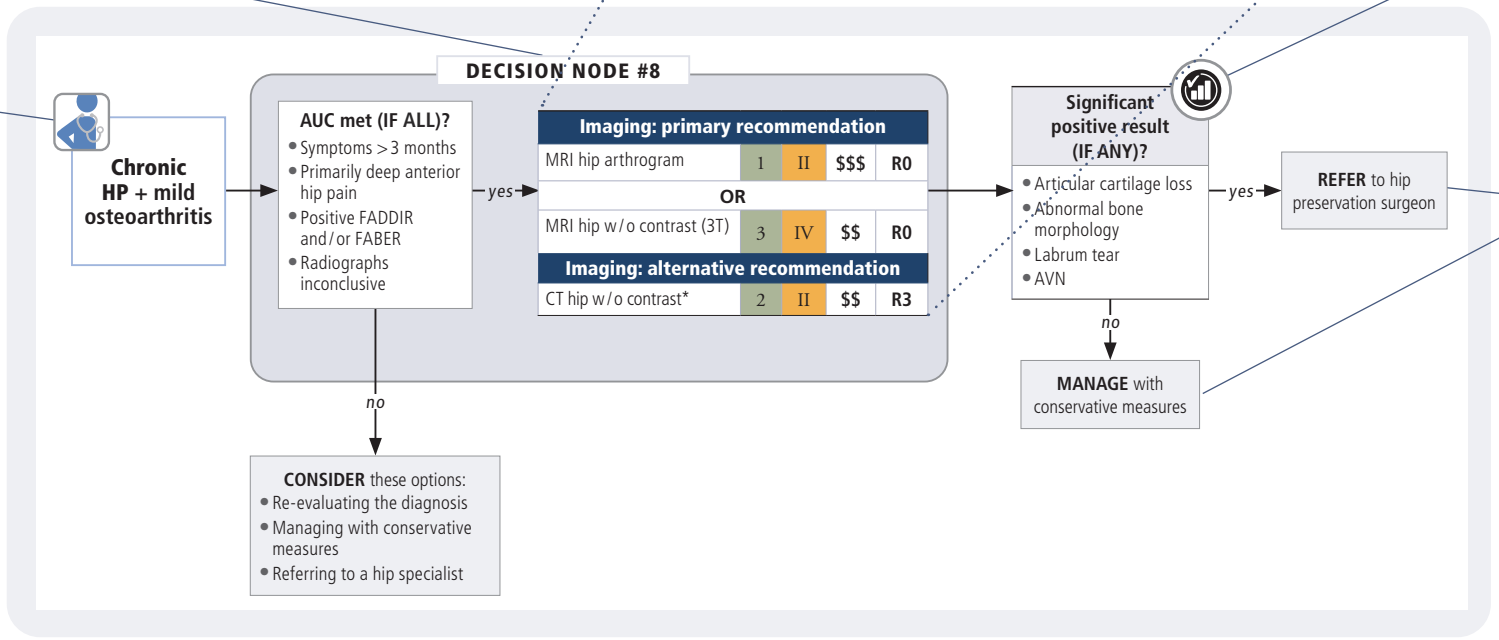
Imaging: primary recommendation				
MRI hip arthrogram	1	II	$$$	R0
OR				
MRI hip w/o contrast (3T)	3	IV	$$	R0
Imaging: alternative recommendation				
CT hip w/o contrast*	2	II	$$	R3

An alternate imaging recommendation has been included for when the primary recommendation is contraindicated or the alternative recommendation may be clinically appropriate.

The decision node box encompasses recommended advanced imaging based on the presence of evidence-based appropriate use criteria (AUC) or expert consensus (where evidence does not exist).

This symbol indicates an Intermountain internal measure. Intermountain measures the incidence of significant positive results on advanced imaging tests.

This symbol indicates a common clinical scenario.



Downstream care recommendations are general guidelines and are subject to the discretion of individual healthcare providers and the providers' system protocols.

Point-of-order checklists

For each advanced imaging test (e.g., MRI and CT), there is a checklist that compiles all of the appropriate use criteria from each clinical scenario (shown in the care pathways) for that test. These are presented in a checklist format for the provider to select the appropriate scenario AND the criteria that apply to the patient's situation.

Tables included on pages 23–27 indicate if the test is a primary recommendation or alternate recommendation.

TABLE 1. MRI hip **without contrast** appropriate use indications (**PRIMARY** recommendation)

POST THA (IF ALL)

- ☐ **HP + suspected psoas irritation**
  - ☐ Persistent anterior hip pain provoked by active hip flexion
  - ☐ Symptoms > 3 months
  - ☐ No radiographic evidence of hardware failure
  - ☐ Failed conservative treatment by hip specialist
- ☐ **HP + suspected ischiofemoral impingement**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Painful sitting and walking
  - ☐ Radiographs indicating narrowed ischiofemoral space
  - ☐ **EITHER** positive long stride **OR** ischiofemoral test
- ☐ **HP + gluteal tendon insertion tear / trochanteric bursitis**
  - ☐ Absence of external snapping and advanced osteoarthritis
  - ☐ Symptoms > 3 months
  - ☐ Pain localized to the peri-trochanter
  - ☐ Negative or noncontributory radiographs

  AND ANY ONE OR MORE OF THESE:
  - ☐ Trendelenburg gait
  - ☐ Pelvic drop during ipsilateral single-leg stand
  - ☐ Abductor weakness
  - ☐ Positive hip lag sign

NOT POST THA (IF ALL)

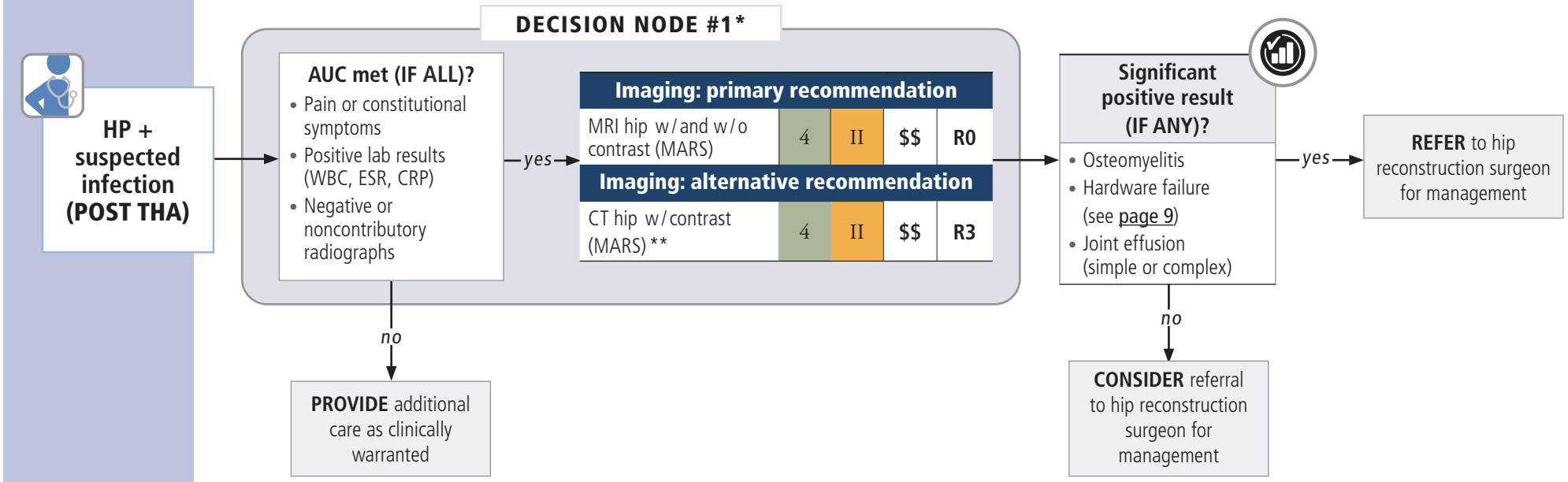
- ☐ **Chronic HP + inflammatory or nonspecific arthropathy**
  - ☐ Nonspecific hip pain
  - ☐ Limited hip range of motion
  - ☐ Radiographs inconclusive
  - ☐ Positive lab workup for inflammatory arthritis
- ☐ **Chronic HP + mild osteoarthritis**
  - ☐ Symptoms > 3 months
  - ☐ Primarily deep anterior hip pain
  - ☐ Positive FADDIR and / or FABER
  - ☐ Radiographs inconclusive
- ☐ **Chronic HP + suspected femoral acetabular impingement or labrum tear**
  - ☐ Symptoms > 3 months
  - ☐ Primarily deep anterior hip pain
  - ☐ Positive FADDIR and / or FABER
  - ☐ Negative or noncontributory radiographs
- ☐ **Chronic HP + suspected ischiofemoral impingement**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Painful sitting and walking
  - ☐ Radiographs indicating narrowed ischiofemoral space
  - ☐ **EITHER** positive long stride **OR** ischiofemoral test
- ☐ **Chronic HP + gluteal tendon insertion tear / trochanteric bursitis**
  - ☐ Absence of external snapping and advanced osteoarthritis
  - ☐ Symptoms > 3 months
  - ☐ Pain localized to the peri-trochanter
  - ☐ Negative or noncontributory radiographs

  AND ANY OF THESE:
  - ☐ Trendelenburg gait
  - ☐ Pelvic drop during ipsilateral single-leg stand
  - ☐ Abductor weakness
  - ☐ Positive hip lag sign
- ☐ **Chronic HP + suspected proximal hamstring tendinopathy**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Pain with heel strike during gait
  - ☐ Positive resisted hamstring at 30 and / or 90 degrees
  - ☐ Painful sitting and walking
  - ☐ Negative or noncontributory radiographs
- ☐ **Acute HP + suspected acute hamstring tear**
  - ☐ Positive mechanism of injury with painful pop
  - ☐ Bruising posterior thigh
  - ☐ Hamstring weakness
  - ☐ Difficulty with weight bearing
  - ☐ Negative or noncontributory radiographs
- ☐ **Acute HP + suspected avulsion fracture**
  - ☐ Positive mechanism of injury with painful pop or bruising
  - ☐ Associated muscle weakness
  - ☐ Difficulty with weight bearing
  - ☐ Radiographs positive or equivocal for avulsion fracture
- ☐ **Acute HP + suspected stress fracture (femoral head / neck)**
  - ☐ Acute groin pain
  - ☐ Positive single-leg hop test
  - ☐ Painful and weak hip flexion
  - ☐ Negative impingement testing
  - ☐ Painful weight bearing
  - ☐ Radiographs positive or equivocal for avulsion fracture
- ☐ **Acute HP + suspected dislocation, post relocation**
  - ☐ Positive mechanism of injury
  - ☐ Persistent pain
  - ☐ Limited hip motion
  - ☐ Radiographs have been performed to ensure proper reduction

HIP PAIN (HP) CARE PATHWAY ALGORITHMS: POST TOTAL HIP ARTHROPLASTY (THA)

See abbreviations on page 2.

For patients who **HAVE** had a total hip arthroplasty (THA) and present with hip pain, clinical scenarios are presented on pages 5 through 10.



* Consider referral to hip arthroplasty surgeon prior to advanced imaging studies

** During pregnancy, CT may be contraindicated. Consult with radiologist.

DECISION NODE #1 KEY EVIDENCE

Cyteval C, Bourdon A. Imaging orthopedic implant infections. *DiagnInter Imaging.* 2012;93(6):547-557.

Cyteval C, Hamm V, Sarrabère MP, Lopez FM, Maury P, Taourel P. Painful infection at the site of hip prosthesis: CT imaging. *Radiology.* 2002;224(2):477-483.

Jiang MH, He C, Feng JM, et al. Magnetic resonance imaging parameter optimizations for diagnosis of periprosthetic infection and tumor recurrence in artificial joint replacement patients. *Sci Rep.* 2016;6:36995.

Verberne SJ, Raijmakers PG, Temmerman OP. The accuracy of imaging techniques in the assessment of periprosthetic hip infection: A systematic review and meta-analysis. *J Bone Joint Surg Am.* 2016;98(19):1638-1645.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

HP + suspected psoas irritation (POST THA)

DECISION NODE #2*

AUC met (IF ALL)?

- Persistent anterior hip pain provoked by active hip flexion
- Symptoms > 3 months
- No radiographic evidence of hardware failure
- Failed conservative treatment by hip specialist

yes →

Imaging: primary recommendation

MRI hip w/o contrast (MARS)	2	II	$$	R0

→ **Significant positive result?**

Iliopsoas bursal effusion / inflammation

yes → **REFER** to hip specialist for management

no → **CONSIDER** referral to hip specialist for management

no → **PROVIDE** additional care as clinically warranted

* Consider referral to hip arthroplasty surgeon prior to advanced imaging studies

DECISION NODE #2 KEY EVIDENCE

Nawabi DH, Gold S, Lyman S, Fields K, Padgett DE, Potter HG. MRI predicts ALVAL and tissue damage in metal-on-metal hip arthroplasty. *Clin Orthop Relat Res.* 2014;472(2):471-481.

Weissman BN, Palestro CJ, Appel M, et al. ACR Appropriateness Criteria® — Imaging after total hip arthroplasty. 2015. Available at https://acsearch.acr.org/docs/3094200/Narrative/. American College of Radiology. Accessed June 16, 2017.

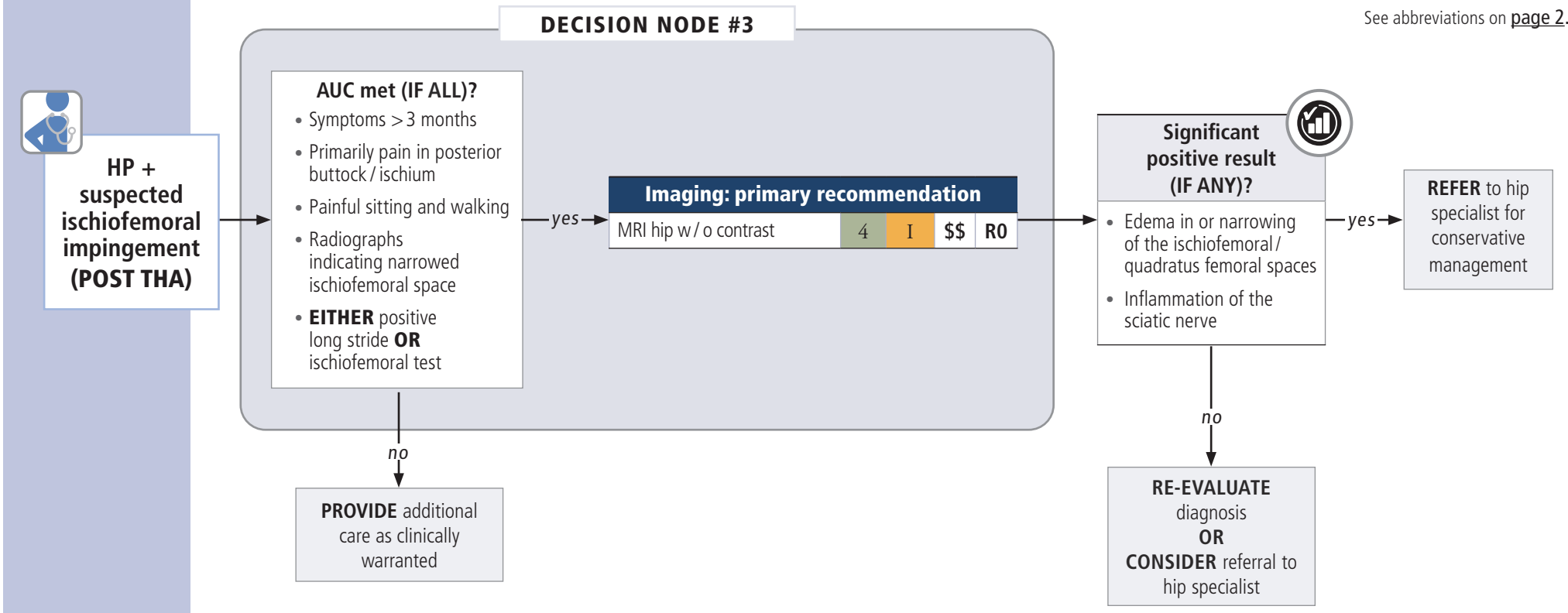
(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **$** (0–5 RVUs) **R3** (1–10 mSv) **$$** (5.01–10 RVUs) **R4** (10.01–30 mSv) **$$$** (10.01–15 RVUs) **$$$$** (15.01+ RVUs) See page 2–3 for explanation.

See abbreviations on page 2.



DECISION NODE #3 KEY EVIDENCE

Potter HG, Nestor BJ, Sofka CM, et al. Magnetic resonance imaging after total hip arthroplasty: Evaluation of periprosthetic soft tissue. *J Bone Joint Surg Am.* 2004;86-A(9):1947-1954.

Weissman BN, Palestro CJ, Appel M, et al. ACR Appropriateness Criteria® — Imaging after total hip arthroplasty. 2015. Available at https://acsearch.acr.org/docs/3094200/Narrative/. American College of Radiology. Accessed June 16, 2017.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

HP + gluteal tendon insertion tear / trochanteric bursitis (POST THA)

DECISION NODE #4

AUC met (IF ALL)?

- Absence of external snapping and advanced osteoarthritis
- Symptoms > 3 months
- Pain localized to the peri-trochanter
- Negative or noncontributory radiographs

AND ANY OF THESE:

- Trendelenburg gait
- Pelvic drop during ipsilateral single-leg stand
- Abductor weakness
- Positive hip lag sign

yes →

Imaging: primary recommendation				
MRI hip w/o contrast	2	II	$$	R0
Imaging: alternative recommendation				
CT hip w/o contrast **	NA*	NA*	$$	R3

Significant positive result (IF ANY)?

- Tear of the gluteus medius / minimus
- Thickeneing of iliotibial band

yes → **REFER** to hip surgeon

no → **RE-EVALUATE** diagnosis **OR** **MANAGE** with conservative measures

no → **PROVIDE** additional care as clinically warranted

* Based on expert opinion in the absence of literature-based evidence

** During pregnancy, CT may be contraindicated. Consult with radiologist.

DECISION NODE #4 KEY EVIDENCE

Cahir JG, Toms AP, Marshall TJ, Wimhurst J, Nolan J. CT and MRI of hip arthroplasty. *Clin Radiol.* 2007;62(12):1163-1171.

Nawabi DH, Gold S, Lyman S, Fields K, Padgett DE, Potter HG. MRI predicts ALVAL and tissue damage in metal-on-metal hip arthroplasty. *Clin Orthop Relat Res.* 2014;472(2):471-481.

Gondim Teixeira PA, Meyer JB, Baumann C, et al. Total hip prosthesis CT with single-energy projection-based metallic artifact reduction: Impact on the visualization of specific periprosthetic soft tissue structures. *Skeletal Radiology.* 2014;43(9):1237-1246.

Weissman BN, Palestro CJ, Appel M, et al. ACR Appropriateness Criteria® — Imaging after total hip arthroplasty. 2015. Available at https://acsearch.acr.org/docs/3094200/Narrative/. American College of Radiology. Accessed June 16, 2017.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

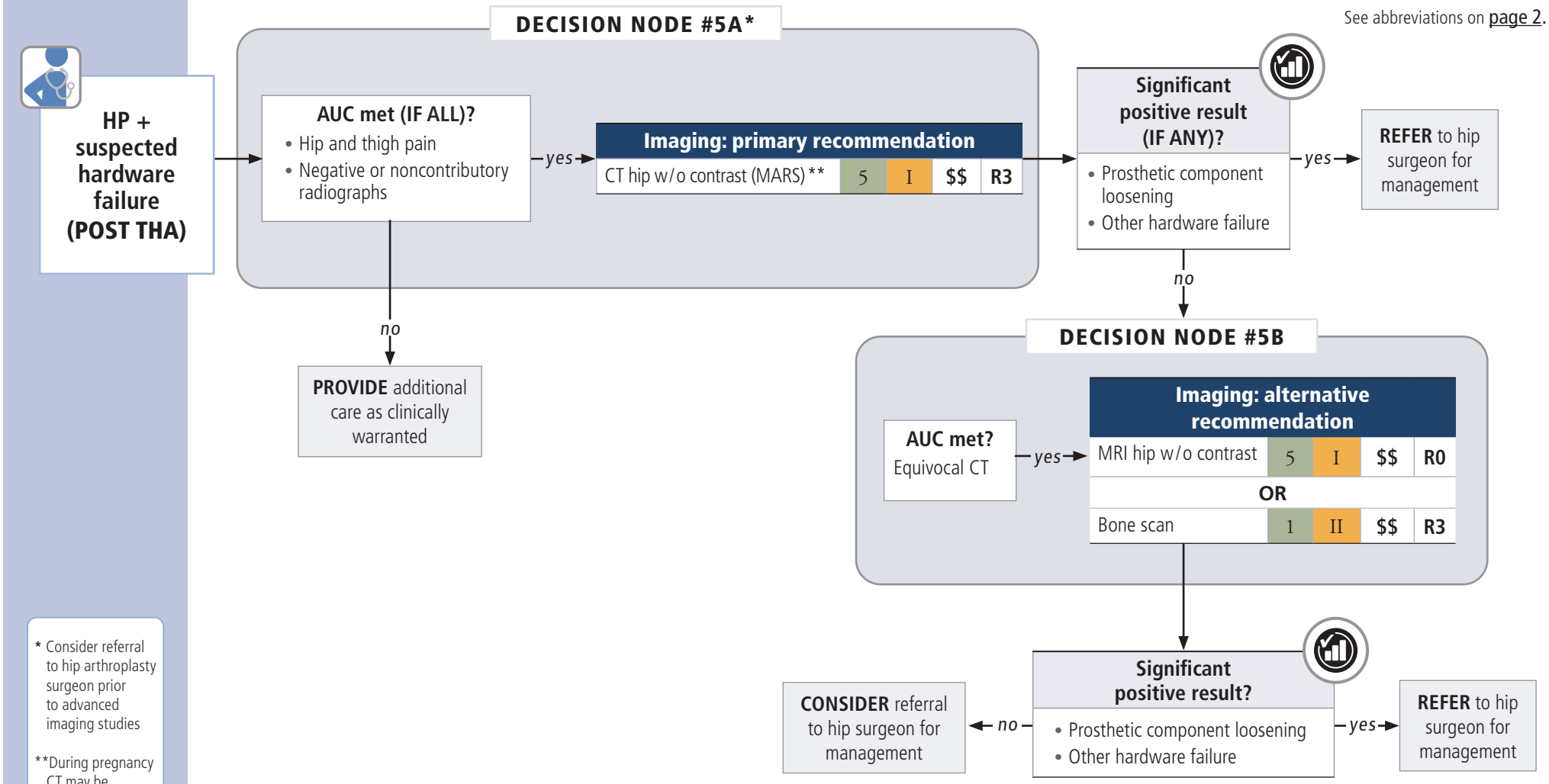
LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

Intermountain Healthcare

See abbreviations on page 2.



* Consider referral to hip arthroplasty surgeon prior to advanced imaging studies

**During pregnancy CT may be contraindicated. Consult with radiologist.

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

DECISION NODE #5A KEY EVIDENCE

Cahir JG, Toms AP, Marshall TJ, Wimhurst J, Nolan J. CT and MRI of hip arthroplasty. *Clin Radiol.* 2007;62(12):1163-1171.

Roth TD, Maertz NA, Parr JA, et al. CT of the hip prosthesis: Appearance of components, fixation, and complications. *Radiographics.* 2012;32(4):1089-1107.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

DECISION NODE #5B KEY EVIDENCE

Cahir JG, Toms AP, Marshall TJ, Wimhurst J, Nolan J. CT and MRI of hip arthroplasty. *Clin Radiol.* 2007;62(12):1163-1171.

Temmerman OP, Raijmakers PG, Berkhof J, Hoekstra OS, Teule GJ, Heyligers IC. Accuracy of diagnostic imaging techniques in the diagnosis of aseptic loosening of the femoral component of a hip prosthesis: A meta-analysis. *J Bone Joint Surg Br.* 2005;87(6):781-785.

Weissman BN, Palestro CJ, Appel M, et al. ACR Appropriateness Criteria® — Imaging after total hip arthroplasty. 2015. Available at https://acsearch.acr.org/docs/3094200/Narrative/. American College of Radiology. Accessed June 16, 2017.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

HIP PAIN (HP) CARE PATHWAY ALGORITHMS: NOT POST-THA

See abbreviations on page 2.

For patients who have **NOT** had a total hip arthroplasty (THA) and present with hip pain, clinical scenarios are grouped as either **chronic** or **acute**. Common **chronic pain** scenarios are covered on pages 11–17. Common **acute pain** scenarios begin on page 18.

Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis

AUC met (IF ALL)?
- Nonspecific hip pain
- Painful limited hip range of motion
- Antalgic gait
- Radiographs inconclusive

yes →

DECISION NODE #6

Imaging: primary recommendation				
MRI hip w/ and w/o contrast (3T)	1	V	$$	R0
OR				
MR hip arthrogram (1.5T)	3	IV	$$$	R0
Imaging: alternative recommendation				
CT hip w/o contrast *	4	IV	$$	R3
OR				
MRI hip w/o contrast	1	II	$$	R0

→ **Significant positive result?**

Avascular necrosis (AVN)

yes → **REFER** to hip surgeon

no → **RE-EVALUATE** diagnosis **OR** **CONSIDER** referral to hip specialist

no → **PROVIDE** additional care as clinically warranted

* During pregnancy, CT may be contraindicated. Consult with radiologist.

DECISION NODE #6 KEY EVIDENCE

Kaushik A, Sankaran B, Varghese M. Prognostic value of dynamic MRI in assessing post-traumatic femoral head vascularity. *Skeletal Radiol.* 2009;38(6):565-569.

Khanna AJ, Yoon TR, Mont MA, Hungerford DS, Bluemke DA. Femoral head osteonecrosis: Detection and grading by using a rapid MR imaging protocol. *Radiology.* 2000;217(1):188-192.

Manenti G, Altobelli S, Pugliese L, Tarantino U. The role of imaging in diagnosis and management of femoral head avascular necrosis. *Clin Cases Miner Bone Metab.* 2015;12(Suppl 1):31-38.

Murphey MD, Roberts CC, Bencardino JT, et al. ACR Appropriateness Criteria® osteonecrosis of the hip. *J Am Coll Radiol.* 2016;13(2):147-155.

Roth A, Beckmann J, Bohndorf K, Fischer A, et al. S3-Guideline non-traumatic adult femoral head necrosis. *Arch Orthop Trauma Surg.* 2016;136(2): 165-174.

Yeh LR, Chen CK, Huang YL, Pan HB, Yang CF. Diagnostic performance of MR imaging in the assessment of subchondral fractures in avascular necrosis of the femoral head. *Skeletal Radiol.* 2009;38(6):559-564.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

Intermountain® Healthcare

See abbreviations on page 2.

Chronic HP + inflammatory or nonspecific arthropathy

DECISION NODE #7

AUC met (IF ALL)?
- Nonspecific hip pain
- Limited hip range of motion
- Radiographs inconclusive
- Positive lab workup for inflammatory arthritis

yes

Imaging: primary recommendation				
MRI hip w/o contrast	1	II	$$	R0
OR				
MRI hip w/ and w/o contrast (depending on expertise)	5	I	$$	R0
Imaging: alternative recommendation				
CT hip w/o contrast*	3	II	$$	R3

Significant positive result?
- Synovitis
- Articular cartilage loss

yes → **REFER** to rheumatologist or hip surgeon (if already under rheumatologist care)

no → **CONSIDER** referral to rheumatologist

no → **PROVIDE** additional care as clinically warranted

* During pregnancy, CT may be contraindicated. Consult with radiologist.

DECISION NODE #7 KEY EVIDENCE

Alasaarela E, Suramo I, Tervonen O, Lähde S, Takalo R, Hakala M. Evaluation of humeral head erosions in rheumatoid arthritis: A comparison of ultrasonography, magnetic resonance imaging, computed tomography and plain radiography. *Br J Rheumatol.* 1998;37(11):1152-1156.

Aleo E, Migone S, Prono V, et al. Imaging techniques in psoriatic arthritis: Update 2012–2014 on current status and future prospects. *J Rheumatol Suppl.* 2015;93:53-56.

Baillet A, Gaujoux-Viala C, Mouterde G, et al. Comparison of the efficacy of sonography, magnetic resonance imaging and conventional radiography for the detection of bone erosions in rheumatoid arthritis patients: A systematic review and meta-analysis. *Rheumatology (Oxford).* 2011;50(6):1137-1147.

Jacobson JA, Roberts CC, Bencardino, JT, et al. ACR Appropriateness Criteria® chronic extremity joint pain—Suspected inflammatory arthritis. *J Am Coll Radiol.* 2017;14(5S):S81-S89.

Mandl P, Navarro-Compán V, Terslev L, et al. EULAR recommendations for the use of imaging in the diagnosis and management of spondyloarthritis in clinical practice. *Ann Rheum Dis.* 2015;74(7):1327-1339.

Sudol-Szopinska I, Mróz J, Ostrowska M, Kwiatkowska B. Magnetic resonance imaging in inflammatory rheumatoid diseases. *Reumatologia.* 2016;54(4):170-176.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

Chronic HP + mild osteoarthritis

DECISION NODE #8

AUC met (IF ALL)?
- Symptoms > 3 months
- Primarily deep anterior hip pain
- Positive FADDIR and/or FABER
- Radiographs inconclusive

yes

Imaging: primary recommendation				
MRI hip arthrogram*	1	II	$$$	R0
OR				
MRI hip w/o contrast (3T)	3	IV	$$	R0
Imaging: alternative recommendation				
CT hip w/o contrast**	2	II	$$	R3

Significant positive result (IF ANY)?
- Articular cartilage loss
- Abnormal bone morphology
- Labrum tear
- AVN

yes → **REFER** to hip preservation surgeon

no → **MANAGE** with conservative measures

no

CONSIDER these options:
- Re-evaluating the diagnosis
- Managing with conservative measures
- Referring to a hip specialist

* Arthrogram also appropriate as pre-operative planning tool

** During pregnancy, CT may be contraindicated. Consult with radiologist

DECISION NODE #8 KEY EVIDENCE

Lee S, Nardo L, Kumar D, et al. Scoring hip osteoarthritis with MRI (SHOMRI): A whole joint osteoarthritis evaluation system. *J Magn Reson Imaging.* 2015;41(6):1549-1557.

Murphey MD, Roberts CC, Bencardino JT, et al. ACR appropriateness criteria osteonecrosis of the hip. *J Am Coll Radiol.* 2016;13(2):147-155.

Quatman CE, Hettrich CM, Schmitt LC, Spindler KP. The clinical utility and diagnostic performance of magnetic resonance imaging for identification of early and advanced knee osteoarthritis: A systematic review. *Am J Sports Med.* 2011;39(7):1557-1568.

Siebelt M, Agricola R, Weinans H, Kim YJ. The role of imaging in early hip OA. *Osteoarthritis Cartilage.* 2014;22(10):1470-1480.

Smith TO, Simpson M, Ejindu V, & Hing, CB. The diagnostic test accuracy of magnetic resonance imaging, magnetic resonance arthrography and computer tomography in the detection of chondral lesions of the hip. *Euro J Orthop Surg Trauma.* 2013;23(3):335-344.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

Chronic HP + suspected femoral acetabular impingement or labrum tear

DECISION NODE #9

AUC met (IF ALL)?
- Symptoms > 3 months
- Primarily deep anterior hip pain
- Positive FADDIR and/or FABER
- Negative or noncontributory radiographs

yes

Imaging: primary recommendation				
MRI hip arthrogram*	1	II	$$$	R0
OR				
MRI hip w/o contrast (3T)	2	II	$$	R0
Imaging: alternative recommendation				
CT hip arthrogram **	1	II	$$$	R3

Significant positive result (IF ANY)?
- Articular cartilage loss
- Abnormal bone morphology
- Labrum tear
- AVN

yes → **REFER** to hip preservation surgeon

no → **MANAGE** with conservative measures **AND** **CONSIDER** other causes for pain

no → **PROVIDE** additional care as clinically warranted

* Arthrogram also appropriate as pre-operative planning tool

**During pregnancy, CT may be contraindicated. Consult with radiologist

DECISION NODE #9 KEY EVIDENCE

Mintz DN, Hooper T, Connell D, Buly R, Padgett DE, Potter HG. Magnetic resonance imaging of the hip: Detection of labral and chondral abnormalities using noncontrast imaging. *Arthroscopy.* 2005;21(4):385-393.

Mintz DN, Roberts CC, Bencardino JT, Baccei SJ, et al. ACR Appropriateness Criteria® chronic hip pain. *J Am Coll Radiol.* 2017;14(5S):S90-S102.

Reiman MP, Thorborg K, Goode AP, Cook CE, Weir A, Hölmich P. Diagnostic accuracy of imaging modalities and injection techniques for the diagnosis of femoroacetabular impingement/labral tear: A systematic review with meta-analysis. *Am J Sports Med.* 2017;45(11):2665-2677.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

Chronic HP + suspected ischiofemoral impingement

DECISION NODE #10

AUC met (IF ALL)?

- Symptoms > 3 months
- Primarily pain in posterior buttock / ischium
- Painful sitting and walking
- Radiographs indicating narrowed ischiofemoral space
- **EITHER** positive long stride **OR** ischiofemoral test

yes →

Imaging: primary recommendation

MRI hip w / o contrast	1	II	$$	R0

→

Significant positive result (IF ANY)?

- Edema in or narrowing of the ischiofemoral / quadratus femoral spaces
- Inflammation of the sciatic nerve

yes → **REFER** to hip specialist for conservative management

no → **RE-EVALUATE** diagnosis **OR** **CONSIDER** referral to hip specialist

no → **PROVIDE** additional care as clinically warranted

DECISION NODE #10 KEY EVIDENCE

Singer AD, Subhawong TK, Jose J, Tresley J, Clifford PD. Ischiofemoral impingement syndrome: A meta-analysis. *Skeletal Radiol.* 2015;44(6):831-837.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

Chronic HP + gluteal tendon insertion tear / trochanteric bursitis

DECISION NODE #11

AUC met (IF ALL)?

- Absence of external snapping and advanced osteoarthritis
- Symptoms > 3 months
- Pain localized to the peri-trochanter
- Negative or noncontributory radiographs

AND ANY OF THESE:

- Trendelenburg gait
- Pelvic drop during ipsilateral single-leg stand
- Abductor weakness
- Positive hip lag sign

no → **PROVIDE** additional care as clinically warranted

yes →

Imaging: primary recommendation

MRI hip w / o contrast	2	II	$$	R0

→ **Significant positive result (IF ANY)?**

- Tear of the gluteus medius / minimus
- Thickening of the iliotibial band

yes → **REFER** to hip surgeon

no → **RE-EVALUATE** diagnosis **OR** **MANAGE** with conservative measures

DECISION NODE #11 KEY EVIDENCE

Mintz DN, Roberts CC, Bencardino JT, et al. ACR Appropriateness Criteria® chronic hip pain. *J Am Coll Radiol.* 2017;14(5S):S90-S102.

Shin AY, Morin WD, Germany JD, Jones SB, Lapinsky AS. The superiority of magnetic resonance imaging in differentiating the cause of hip pain in endurance athletes. *Am J Sports Med.* 1996;24(2):168-176.

Westacott DJ, Minns JI, Foguet P. The diagnostic accuracy of magnetic resonance imaging and ultrasonography in gluteal tendon tears—A systematic review. *Hip Int.* 2011;21(6):637-645.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

Intermountain® Healthcare

See abbreviations on page 2.

Chronic HP + suspected proximal hamstring tendinopathy

DECISION NODE #12

AUC met (IF ALL)?

- Symptoms > 3 months
- Primarily pain in posterior buttock / ischium
- Pain with heel strike during gait
- Positive resisted hamstring at 30 and / or 90 degrees
- Painful sitting and walking
- Negative or noncontributory radiographs

yes →

Imaging: primary recommendation				
MRI hip w / o contrast	2	II	$$	R0
Imaging: alternative recommendation				
CT hip w / o contrast *	5	I	$$	R3

Significant positive result (IF ANY)?

- Tendinopathy of hamstring origin
- Edema of the ischiofemoral space
- Inflammation of the sciatic nerve

yes → **REFER** to hip surgeon

no → **RE-EVALUATE** diagnosis **OR** **MANAGE** with conservative measures

no → **PROVIDE** additional care as clinically warranted

* During pregnancy, CT may be contraindicated. Consult with radiologist

DECISION NODE #12 KEY EVIDENCE

Mintz DN, Roberts CC, Bencardino JT, et al. ACR Appropriateness Criteria® chronic hip pain. *J Am Coll Radiol.* 2017;14(5S):S90-S102.

Shin AY, Morin WD, Germany JD, Jones SB, Lapinsky AS. The superiority of magnetic resonance imaging in differentiating the cause of hip pain in endurance athletes. *Am J Sports Med.* 1996;24(2):168-176.

Westacott DJ, Minns JI, Foguet P. The diagnostic accuracy of magnetic resonance imaging and ultrasonography in gluteal tendon tears—A systematic review. *Hip Int.* 2011;21(6):637-645.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

For patients who have **NOT** had a total hip arthroplasty (THA) and present with hip pain, clinical scenarios are grouped as either **chronic** or **acute**. Common **chronic pain** scenarios were covered on pages 11–17. For common **acute pain** scenarios, see pages 18–22.

See abbreviations on page 2.

Acute HP + suspected acute hamstring tear

DECISION NODE #13

AUC met (IF ALL)?

- Positive mechanism of injury with a painful pop
- Bruising posterior thigh
- Hamstring weakness
- Difficulty with weight bearing
- Negative or noncontributory radiographs

yes →

Imaging: primary recommendation

MRI hip w/o contrast	2	II	$$	R0

→

Significant positive result?

Avulsion of hamstring origin

yes → **REFER** to hip surgeon

no → **MANAGE** with conservative measures

no → **PROVIDE** additional care as clinically warranted

DECISION NODE #13 KEY EVIDENCE

Mintz DN, Roberts CC, Bencardino JT, et al. ACR Appropriateness Criteria® chronic hip pain. *J Am Coll Radiol.* 2017;14(5S):S90-S102.

Shin AY, Morin WD, Germany JD, Jones SB, Lapinsky AS. The superiority of magnetic resonance imaging in differentiating the cause of hip pain in endurance athletes. *Am J Sports Med.* 1996;24(2):168-176.

Westacott DJ, Minns JI, Foguet P. The diagnostic accuracy of magnetic resonance imaging and ultrasonography in gluteal tendon tears—A systematic review. *Hip Int.* 2011;21(6):637-645.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

Acute HP + suspected avulsion fracture*

DECISION NODE #14

AUC met (IF ALL)?

- Positive mechanism of injury with painful pop or bruising
- Associated muscle weakness
- Difficulty with weight bearing
- Radiographs positive or equivocal for avulsion fracture

yes →

Imaging: primary recommendation

MRI hip w/o contrast	1	VI	$$	R0

Imaging: alternative recommendation

CT hip w/o contrast**	2	II	$$	R3

→ **Significant positive result?**

Avulsion fracture with significant displacement

yes → **REFER** to hip surgeon

no → **MANAGE** with conservative measures

no → **PROVIDE** additional care as clinically warranted

* Avulsion fractures include fractures of the ischium, lesser trochanter, and ASIS (anterior superior iliac spine).

**During pregnancy, CT may be contraindicated. Consult with radiologist

DECISION NODE #14 KEY EVIDENCE

Chatha H, Ullah S, Cheema Z. Review article: Magnetic resonance imaging and computed tomography in the diagnosis of occult proximal femur fractures. *J Ortho Surg (Hong Kong).* 2011;19(1):99-103.

Kim SJ, Ahn J, Kim HK, Kim JH. Is magnetic resonance imaging necessary in isolated greater trochanter fracture? A systemic review and pooled analysis. *BMC Musculoskelet Disord.* 2015;16:395.

Ward RJ, Weissman BN, Kransdorf MJ, et al. ACR Appropriateness Criteria® acute hip pain—Suspected fracture. *J Am Coll Radiol.* 2014;11(2):114-120.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.

Acute HP + suspected stress fracture (femoral head/neck)

DECISION NODE #15

AUC met (IF ALL)?

- Acute groin pain
- Positive single-leg hop test
- Painful and weak hip flexion
- Negative impingement testing
- Painful weight bearing
- Radiographs positive or equivocal for fracture

yes

Imaging: primary recommendation				
MRI hip w/o contrast	1	II	$$	R0
Imaging: alternative recommendation				
CT hip w/o contrast *	5	I	$$	R3

Significant positive result?

Stress fracture

yes → **REFER** to hip surgeon

no → **MANAGE** with conservative measures

no → **PROVIDE** additional care as clinically warranted

*During pregnancy, CT may be contraindicated. Consult with radiologist

DECISION NODE #15 KEY EVIDENCE

Bencardino JT, Stone TJ, Roberts CC, et al. ACR Appropriateness Criteria® (fatigue/insufficiency) fracture, including sacrum, excluding other vertebrae. *J Am Coll Radiol.* 2017;14(5):S293-S306.

Kiuru MJ, Pihlajamaki HK, Hietanen HJ, Ahovuo JA. MR imaging, bone scintigraphy, and radiography in bone stress injuries of the pelvis and the lower extremity. *Acta Radiol.* 2002;43(2):207-212.

Wright AA, Hegedus EJ, Lenchik L, Kuhn KJ, Santiago L, Smoliga JM. Diagnostic accuracy of various imaging modalities for suspected lower extremity stress fractures: A systematic review with evidence-based recommendations for clinical practice. *Am J Sports Med.* 2016;44(1):255-263.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

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See abbreviations on page 2.

Acute HP + suspected dislocation (post relocation)

DECISION NODE #16

AUC met (IF ALL)?
- Positive mechanism of injury
- Persistent pain
- Limited hip motion
- Radiographs have been performed to ensure proper reduction

yes →

Imaging: primary recommendation

MRI hip w/o contrast (3 T)	1	VI	$$	R0
OR				
MRI hip arthrogram (1.5 T)	4	II	$$$	R0

Imaging: alternative recommendation

CT hip w/o contrast *	2	II	$$	R3

Significant positive result (IF ANY)?
- Osteochondral injury
- Loose bodies

yes → **REFER** to hip surgeon

no → **MANAGE** with conservative measures

no → **PROVIDE** additional care as clinically warranted

* During pregnancy, CT may be contraindicated. Consult with radiologist

DECISION NODE #16 KEY EVIDENCE

Chatha H, Ullah S, Cheema Z. Review article: Magnetic resonance imaging and computed tomography in the diagnosis of occult proximal femur fractures. *J Ortho Surg (Hong Kong).* 2011;19(1):99-103.

Kim SJ, Ahn J, Kim HK, Kim JH. Is magnetic resonance imaging necessary in isolated greater trochanter fracture? A systemic review and pooled analysis. *BMC Musculoskelet Disord.* 2015;16:395.

Lang P, Mauz M, Schorner W, et al. Acute fracture of the femoral neck: assessment of femoral head perfusion with gadopentetate dimeglumine-enhanced MR imaging. *AJR Am J roentgenol.* 1993;160(2):335-341.

Ward RJ, Weissman BN, Kransdorf MJ, et al. ACR Appropriateness Criteria® acute hip pain—Suspected fracture. *J Am Coll Radiol.* 2014;11(2):114-120.

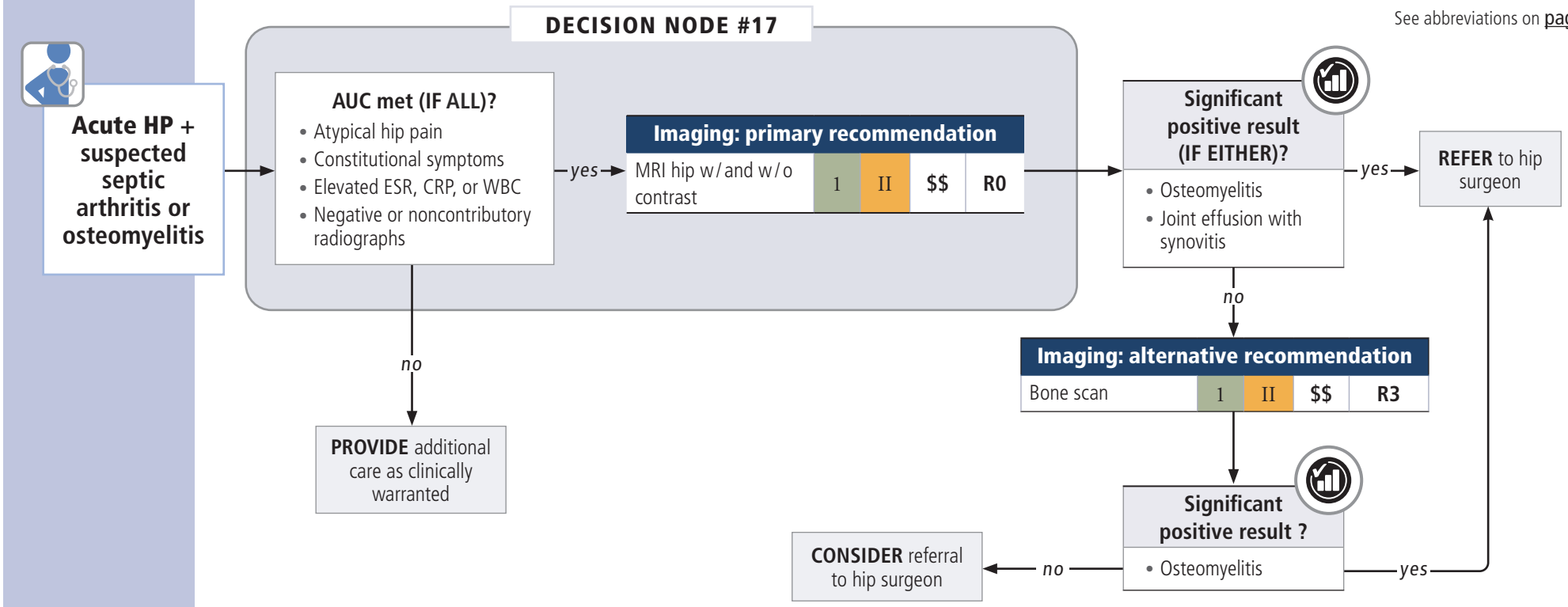
(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

See abbreviations on page 2.



DECISION NODE #17 KEY EVIDENCE

Beaman FD, von Herrmann PF, Kransdorf MJ, et al. ACR Appropriateness Criteria® suspected osteomyelitis, septic arthritis, or soft tissue infection (excluding spine and diabetic foot). *J Am Coll Radiol.* 2017;14(5S):S326-S337.

Termaat MF, Raijmakers PG, Scholten HJ, Bakker FC, Patka P, Haarman HJ. The accuracy of diagnostic imaging for the assessment of chronic osteomyelitis: A systematic review and meta-analysis. *J Bone Joint Surg Am.* 2005;87(11):2464-2471.

Wang GL, Zhao K, Liu ZF, Dong MJ, Yang SY. A meta-analysis of fluorodeoxyglucose-positron emission tomography versus scintigraphy in the evaluation of suspected osteomyelitis. *Nucl Med Commun.* 2011;32(12):1134-1142.

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10.01–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5.01–10 RVUs) **$$$** (10.01–15 RVUs) **$$$$ (15.01+ RVUs)

POINT-OF-ORDER CHECKLISTS

The provider must check BOTH:

1. The box next to the relevant clinical scenario
2. EACH AUC box that applies to the patient's situation

TABLE 1. MRI hip **without contrast** appropriate use indications (**PRIMARY** recommendation)

POST THA (IF ALL)

- ☐ **HP + suspected psoas irritation**
  - ☐ Persistent anterior hip pain provoked by active hip flexion
  - ☐ Symptoms > 3 months
  - ☐ No radiographic evidence of hardware failure
  - ☐ Failed conservative treatment by a hip specialist
- ☐ **HP + suspected ischiofemoral impingement**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Painful sitting and walking
  - ☐ Radiographs indicating narrowed ischiofemoral space
  - ☐ **EITHER** positive long stride **OR** ischiofemoral test
- ☐ **HP + gluteal tendon insertion tear / trochanteric bursitis**
  - ☐ Absence of external snapping and advanced osteoarthritis
  - ☐ Symptoms > 3 months
  - ☐ Pain localized to the peri-trochanter
  - ☐ Negative or noncontributory radiographs

  AND ANY ONE OR MORE OF THESE:
  - ☐ Trendelenburg gait
  - ☐ Pelvic drop during ipsilateral single-leg stand
  - ☐ Abductor weakness
  - ☐ Positive hip lag sign

NOT POST THA (IF ALL)

- ☐ **Chronic HP + inflammatory or nonspecific arthropathy**
  - ☐ Nonspecific hip pain
  - ☐ Limited hip range of motion
  - ☐ Radiographs inconclusive
  - ☐ Positive lab workup for inflammatory arthritis
- ☐ **Chronic HP + mild osteoarthritis**
  - ☐ Symptoms > 3 months
  - ☐ Primarily deep anterior hip pain
  - ☐ Positive FADDIR and / or FABER
  - ☐ Radiographs inconclusive
- ☐ **Chronic HP + suspected femoral acetabular impingement or labrum tear**
  - ☐ Symptoms > 3 months
  - ☐ Primarily deep anterior hip pain
  - ☐ Positive FADDIR and / or FABER
  - ☐ Negative or noncontributory radiographs
- ☐ **Chronic HP + suspected ischiofemoral impingement**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Painful sitting and walking
  - ☐ Radiographs indicating narrowed ischiofemoral space
  - ☐ **EITHER** positive long stride **OR** ischiofemoral test
- ☐ **Chronic HP + gluteal tendon insertion tear / trochanteric bursitis**
  - ☐ Absence of external snapping and advanced osteoarthritis
  - ☐ Symptoms > 3 months
  - ☐ Pain localized to the peri-trochanter
  - ☐ Negative or noncontributory radiographs

  AND ANY OF THESE:
  - ☐ Trendelenburg gait
  - ☐ Pelvic drop during ipsilateral single-leg stand
  - ☐ Abductor weakness
  - ☐ Positive hip lag sign
- ☐ **Chronic HP + suspected proximal hamstring tendinopathy**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Pain with heel strike during gait
  - ☐ Positive resisted hamstring at 30 and / or 90 degrees
  - ☐ Painful sitting and walking
  - ☐ Negative or noncontributory radiographs
- ☐ **Acute HP + suspected acute hamstring tear**
  - ☐ Positive mechanism of injury with a painful pop
  - ☐ Bruising posterior thigh
  - ☐ Hamstring weakness
  - ☐ Difficulty with weight bearing
  - ☐ Negative or noncontributory radiographs
- ☐ **Acute HP + suspected avulsion fracture**
  - ☐ Positive mechanism of injury with a painful pop or bruising
  - ☐ Associated muscle weakness
  - ☐ Difficulty with weight bearing
  - ☐ Radiographs positive or equivocal for avulsion fracture
- ☐ **Acute HP + suspected stress fracture (femoral head / neck)**
  - ☐ Acute groin pain
  - ☐ Positive single-leg hop test
  - ☐ Painful and weak hip flexion
  - ☐ Negative impingement testing
  - ☐ Painful weight-bearing
  - ☐ Radiographs positive or equivocal for avulsion fracture
- ☐ **Acute HP + suspected dislocation, post-relocation**
  - ☐ Positive mechanism of injury
  - ☐ Persistent pain
  - ☐ Limited hip motion
  - ☐ Radiographs have been performed to ensure proper reduction

POINT-OF-ORDER CHECKLISTS, CONTINUED

TABLE 2. MRI hip **without contrast** appropriate use indications (**ALTERNATIVE** recommendation)

POST THA (IF ALL)	**NOT** POST THA (IF ALL)
☐ **HP + suspected hardware failure** ☐ Hip and thigh pain ☐ Negative or noncontributory radiographs ☐ Equivocal CT	☐ **Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis** ☐ Nonspecific hip pain ☐ Radiographs inconclusive ☐ Painful limited hip range of motion ☐ Antalgic gait

TABLE 3. MRI hip **with and without contrast** appropriate use indications (**PRIMARY** recommendation)

POST THA (IF ALL)	**NOT** POST THA (IF ALL)
☐ **HP + suspected infection** ☐ Pain or constitutional symptoms ☐ Positive lab results (WBC, ESR, CRP) ☐ Negative or noncontributory radiographs	☐ **Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis** ☐ Nonspecific hip pain ☐ Painful limited hip range of motion ☐ Antalgic gait ☐ Radiographs inconclusive ☐ **Chronic HP + inflammatory or nonspecific arthropathy (depending on expertise)** ☐ Nonspecific hip pain ☐ Limited hip range of motion ☐ Radiographs inconclusive ☐ Positive lab workup for inflammatory arthritis ☐ **Acute HP + suspected septic arthritis or osteomyelitis** ☐ Atypical hip pain ☐ Constitutional symptoms ☐ Elevated ESR, CRP, or WBC ☐ Negative or noncontributory radiographs

POINT-OF-ORDER CHECKLISTS, CONTINUED

TABLE 4. MRI hip **arthrogram** appropriate use indications (**PRIMARY** recommendation)

NOT POST THA (IF ALL)

☐ **Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis** ☐ Nonspecific hip pain ☐ Painful limited hip range of motion ☐ Antalgic gait ☐ Radiographs inconclusive	☐ **Chronic HP + mild osteoarthritis** ☐ Symptoms > 3 months ☐ Primarily deep anterior hip pain ☐ Positive FADDIR and/or FABER ☐ Radiographs inconclusive	☐ **Chronic HP + suspected femoral acetabular impingement or labrum tear** ☐ Symptoms > 3 months ☐ Primarily deep anterior hip pain ☐ Positive FADDIR and/or FABER ☐ Negative or noncontributory radiographs	☐ **Acute HP + suspected dislocation, post-relocation** ☐ Positive mechanism of injury ☐ Persistent pain ☐ Limited hip motion ☐ Radiographs have been performed to ensure proper reduction

TABLE 5. CT hip **without contrast*** appropriate use indications (**PRIMARY** recommendation)

POST THA (IF ALL)

☐ **HP + suspected hardware failure**
- ☐ Hip and thigh pain
- ☐ Negative or noncontributory radiographs

*During pregnancy, CT may be contraindicated. Consult with radiologist.

TABLE 6. CT hip **with contrast*** appropriate use indications (**ALTERNATIVE** recommendation)

POST THA (IF ALL)

☐ **HP + suspected infection**
- ☐ Pain or constitutional symptoms
- ☐ Positive lab results (WBC, ESR, CRP)
- ☐ Negative or noncontributory radiographs

*During pregnancy, CT may be contraindicated. Consult with radiologist.

POINT-OF-ORDER CHECKLISTS, CONTINUED

TABLE 7. CT hip **without contrast*** appropriate use indications (**ALTERNATIVE** recommendation)

POST THA (IF ALL)

- ☐ **HP + gluteal tendon insertion tear / trochanteric bursitis**
  - ☐ Absence of external snapping and advanced osteoarthritis
  - ☐ Symptoms > 3 months
  - ☐ Pain localized to the peri-trochanter
  - ☐ Negative or nondcontributory radiographs

  AND ANY ONE OR MORE OF THESE:
  - ☐ Trendelenburg gait
  - ☐ Pelvic drop during ipsilateral single-leg stand
  - ☐ Abductor weakness
  - ☐ Positive hip lag sign

NOT POST THA (IF ALL)

- ☐ **Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis**
  - ☐ Nonspecific hip pain
  - ☐ Painful limited hip range of motion
  - ☐ Antalgic gait
  - ☐ Radiographs inconclusive
- ☐ **Chronic HP + inflammatory or nonspecific arthropathy**
  - ☐ Nonspecific hip pain
  - ☐ Limited hip range of motion
  - ☐ Radiographs inconclusive
  - ☐ Positive lab workup for inflammatory arthritis
- ☐ **Chronic HP + suspected proximal hamstring tendinopathy**
  - ☐ Symptoms > 3 months
  - ☐ Primarily pain in posterior buttock / ischium
  - ☐ Pain with heel strike during gait
  - ☐ Positive resisted hamstring at 30 and / or 90 degrees
  - ☐ Painful sitting and walking
  - ☐ Negative or noncontributory radiographs
- ☐ **Chronic HP + mild osteoarthritis (also appropriate as pre-operative planning tool)**
  - ☐ Symptoms > 3 months
  - ☐ Primarily deep anterior hip pain
  - ☐ Positive FADDIR and / or FABER
  - ☐ Radiographs inconclusive
- ☐ **Acute HP + suspected avulsion fracture**
  - ☐ Positive mechanism of injury with a painful pop or bruising
  - ☐ Associated muscle weakness
  - ☐ Difficulty with weight bearing
  - ☐ Positive radiographs for avulsion fracture
- ☐ **Acute HP + suspected stress fracture (femoral head / neck)**
  - ☐ Acute groin pain
  - ☐ Positive single-leg hop test
  - ☐ Painful and weak hip flexion
  - ☐ Negative impingement testing
  - ☐ Painful weight-bearing
  - ☐ Radiographs positive or equivocal for fracture
- ☐ **Acute HP + suspected dislocation, post-relocation**
  - ☐ Positive mechanism of injury
  - ☐ Persistent pain
  - ☐ Limited hip motion
  - ☐ Radiographs have been performed to ensure proper reduction

*During pregnancy, CT may be contraindicated. Consult with radiologist.

POINT-OF-ORDER CHECKLISTS, CONTINUED

TABLE 8. CT **arthrogram*** appropriate use indications (**ALTERNATIVE** recommendation)
NOT POST THA (IF ALL)
☐ **Chronic HP + suspected femoral acetabular impingement or labrum tear**
☐ Symptoms > 3 months
☐ Primarily deep anterior hip pain
☐ Positive FADDIR and / or FABER
☐ Negative or noncontributory radiographs

*During pregnancy, CT may be contraindicated. Consult with radiologist.

TABLE 9. Bone scan appropriate use indications (**ALTERNATIVE** recommendation)	
POST THA (IF ALL)	**NOT** POST THA (IF ALL)
☐ **HP + suspected hardware failure**	☐ **Acute HP + suspected septic arthritis or osteomyelitis (at the discretion of the hip surgeon)**
☐ Hip and thigh pain	☐ Atypical hip pain
☐ Negative or noncontributory radiographs	☐ Constitutional symptoms
☐ Equivocal CT	☐ Elevated ESR, CRP, or WBC
	☐ No significant positive finding on MRI

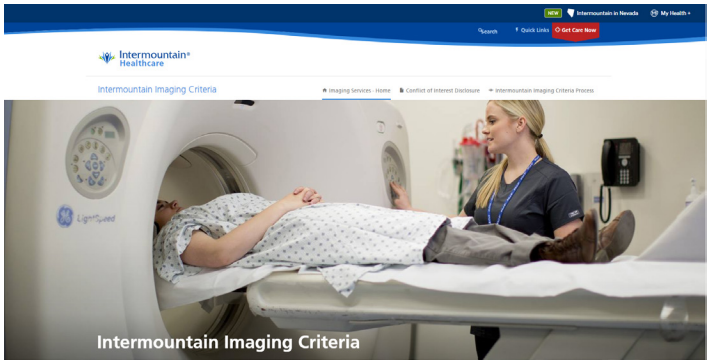
RESOURCES

Intermountain provides educational materials designed to support providers in their efforts to care for, educate, and engage patients and their families.

Intermountain's patient education materials complement and reinforce clinical team interventions by providing a means for patients to reflect and learn in another mode and at their own pace.

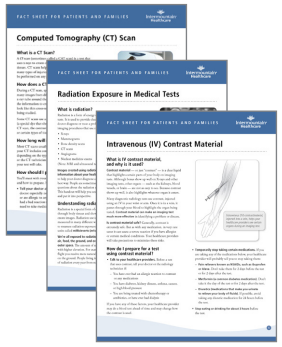
Intermountain's Care Process Models (CPMs) outline evidence-based guidelines for patient care. In addition to the suite of Intermountain Imaging Criteria CPMs, Intermountain provides topical CPMs that have been developed by expert clinical teams. They can be accessed by navigating to intermountainphysician.org and selecting **Care Process Models** in the **Tools and Resources** drop-down menu.

To access Intermountain's Imaging Criteria CPMs and supporting materials, visit: https://intermountainhealthcare.org/services/imaging-services/intermountain-imaging-criteria/.



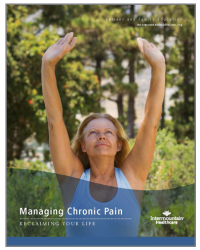
Fact sheets:

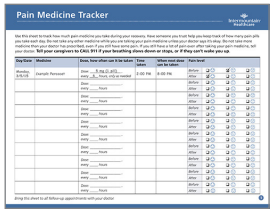
- *Hip Replacement Surgery: Home instructions*
- *Surgery for Hip Fracture (Geriatric)*
- *Treatment for Hip Fracture: A decision guide*



Fact sheets:

- *Computed Tomography (CT) Scan*
- *Radiation Exposure in Medical Tests*
- *Intravenous (IV) Contrast Material*

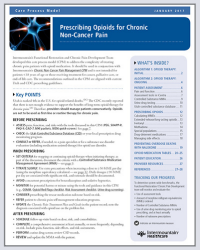




Patient education:

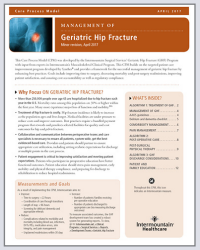
- *Managing Chronic Pain*
- *Pain Med Tracking Sheet*

Related Care Process Models (CPMs):



Prescribing Opioids for Chronic Pain CPM

Imaging Radiation Exposure CPM



Geriatric Hip Fracture CPM

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OCE OCEBM Levels of Evidence Working Group; Oxford Centre for Evidence-Based Medicine. The Oxford 2011 Levels of Evidence. http://www.cebm.net/index.aspx?o=5653. Accessed July 31, 2017.

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This CPM presents a model of best care based on the best available scientific evidence at the time of publication. It is not a prescription for every physician or every patient, nor does it replace clinical judgment. All statements, protocols, and recommendations herein are viewed as transitory and iterative. Although physicians are encouraged to follow the CPM to help focus on and measure quality, deviations are a means for discovering improvements in patient care and expanding the knowledge base.