Through its Proven Imaging 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 PROVEN IMAGING?**

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. The inflating costs of advanced imaging outstripped that of any other medical service. These inflating costs resulted in up to $20–30 billion in unnecessary advanced imaging spending each year.

- **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.
- **Limited effectiveness.** Multiple studies suggest that up to a third of advanced imaging procedures fail to contribute to diagnosis or are clinically inappropriate.
- **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 Proven Imaging approach seeks to avoid these risks.
PROVEN IMAGING FOR Hip Pain (HP)

OVERVIEW: PROVEN IMAGING APPROPRIATE USE CRITERIA CONTENT

Intermountain Proven Imaging appropriate use criteria (AUC) support clinicians in providing evidence-based care to the patients they serve. Although appropriate use of Proven Imaging 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/proven-imaging/.

The care process model approach

Designed as care process models (CPMs), the Proven Imaging 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 Proven Imaging 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, Proven Imaging 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, Proven Imaging 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.° The radiation risk is derived from data published in 2010 by the Health Physics Society.°°

Evidentiary review and ranking

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

   This standard includes categorical ranking grades relevant to diagnostic studies and rates individual sources of evidence (published papers or other research data) on a five-point scale.°°°

2. The extensively used Fryback and Thornbury conceptual framework, which uses six levels for assessing the efficacy of diagnostic imaging.°°°°

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.

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

POST THA:

| HP + infection | 5 |
| HP + psoas irritation | 6 |
| HP + ischiofemoral impingement | 7 |
| HP + gluteus medius/minimus tear | 8 |
| HP + hardware failure | 9 |

NOT POST THA

Chronic HP +:

| AVN / osteonecrosis | 11 |
| Inflammatory / non-specific arthropathy | 12 |
| Mild osteoarthritis | 13 |
| Femoral acetabular impingement/labrum tear | 14 |
| Ischiofemoral impingement | 15 |
| Gluteus medius/minimus tear | 16 |
| Proximal hamstring tendinopathy | 17 |

Acute HP +:

| Acute hamstring tear | 18 |
| Avulsion fractures | 19 |
| Stress fracture | 20 |
| Dislocation | 21 |
| Septic arthritis / osteomyelitis | 22 |

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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.

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).

See abbreviations on page 2.
### 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 + suspected gluteus medius/minimus tear
  - Absence of external snapping and advanced osteoarthritis
  - Symptoms > 3 months
  - Pain localized to the peri-trochanter
  - Negative or noncontributory radiographs
  - AND ANY ONE 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
  - 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

Note: Tables included on pages 23–27 indicate if the test is a primary recommendation or alternate recommendation.
**HIP PAIN (HP) CARE PATHWAY ALGORITHMS:**
**POST TOTAL HIP ARTHROPLASTY (THA)**

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

### DECISION NODE #1*

**HP + suspected infection (POST THA)**

- AUC met (IF ALL)?
  - Pain or constitutional symptoms
  - Positive lab results (WBC, ESR, CRP)
  - Negative or noncontributory radiographs

  **Imaging: primary recommendation**
  - MRI hip w/and w/o contrast (MARS)
  - Level of Evidence: II
  - R0

  **Imaging: alternative recommendation**
  - CT hip w/contrast (MARS)
  - Level of Evidence: II
  - R3

  **DECISION NODE #1 KEY EVIDENCE**


**DECISION NODE #1 KEY EVIDENCE**

- Osteomyelitis
- Hardware failure (see page 9)
- Joint effusion (simple or complex)

**DECISION NODE #1 RECOMMENDATIONS**

- **Imaging: primary recommendation**
  - MRI hip w/and w/o contrast (MARS)
  - Level of Evidence: II
  - R0

- **Imaging: alternative recommendation**
  - CT hip w/contrast (MARS)
  - Level of Evidence: II
  - R3

**DECISION NODE #1* CONSIDER** referral to hip reconstruction surgeon for management

**DECISION NODE #1* PROVIDE** additional care as clinically warranted

**DECISION NODE #1* REFER** to hip reconstruction surgeon for management

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

**Imaging: primary recommendation**
- MRI hip w/o contrast (MARS) - Level of Evidence II

**Significant positive result?**
- Iliopsoas bursal effusion/inflammation
  - yes → REFER to hip specialist for management
  - no → CONSIDER referral to hip specialist for management

**DECISION NODE #2 KEY EVIDENCE**


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

**LEGEND**

- Clinical Scenario
- Urgent or Emergency Situation
- OCEBM Level of Evidence
- Fryback & Thornbury Level of Evidence
- Intermountain Measure
- \( R_0 \) (0 mSv) \( R_3 \) (1 – 10 mSv) \( R_4 \) (10.01 – 30 mSv) See page 2 – 3 for explanation.
- $ (0 – 5 RVUs) \$ (5.01 – 10 RVUs) \$$ (10.01 – 15 RVUs) \$$ (15.01+ RVUs)
PROVEN IMAGING FOR Hip Pain (HP)

DECISION NODE #3

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

Imaging: primary recommendation

MRI hip w/o contrast

Significant positive result (IF ANY)?
- Edema in or narrowing of the ischiofemoral/quadraatus femoral spaces
- Inflammation of the sciatic nerve

Yes

MRI hip w/ contrast

REFERR to hip specialist for conservative management

No

PROVIDE additional care as clinically warranted

DECISION NODE #3 KEY EVIDENCE


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**PROVEN IMAGING FOR** **Hip Pain (HP)**

---

**DECISION NODE #4**

**HP + suspected gluteus medius/minus tear (POST THA)**

- **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

- **Imaging:**
  - **Primary recommendation:**
    - MRI hip w/o contrast
    - Level of Evidence: II
    - Measure: $$
    - Radiation dose: \( \text{R0} \) (0 mSv)
  - **Alternative recommendation:**
    - CT hip w/o contrast
    - Level of Evidence: NA*
    - Measure: $$
    - Radiation dose: \( \text{R3} \) (1 – 10 mSv)

---

**DECISION NODE #4 KEY EVIDENCE**


---

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

---

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**PROVEN IMAGING FOR Hip Pain (HP)**

### DECISION NODE #5A*

**HP + suspected hardware failure (POST THA)?**

- **AUC met (IF ALL)?**
  - Yes
    - **Imaging: primary recommendation**
      - CT hip w/o contrast (MARS)
      - Level of Evidence: II
      - $\text{R0}$ (0 mSv)
    - **Significant positive result (IF ANY)?**
      - Yes
        - Refer to hip surgeon for management
      - No
        - No
        - Provide additional care as clinically warranted
  - No
    - Refer to hip arthroplasty surgeon prior to advanced imaging studies

- **No**
  - Refer to hip surgeon for management

### DECISION NODE #5B

- **AUC met?**
  - Yes
    - **Imaging: alternative recommendation**
      - MRI hip w/o contrast
      - Level of Evidence: II
      - $\text{R0}$ (0 mSv)
      - OR
      - Bone scan
    - **Significant positive result?**
      - Yes
        - Refer to hip surgeon for management
      - No
        - Provide additional care as clinically warranted
  - No
    - Refer to hip surgeon for management

---

**LEGEND**

- OCEBM Level of Evidence
- Fryback & Thornbury Level of Evidence
- Intermountain Measure

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PROVEN IMAGING FOR Hip Pain (HP)

DECISION NODE #5A KEY EVIDENCE


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

DECISION NODE #5B KEY EVIDENCE


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**HIP PAIN (HP) CARE PATHWAY ALGORITHMS: NOT POST-THA**

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.

### DECISION NODE #6

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

**Imaging: primary recommendation**
- MRI hip w/ and w/o contrast (3T)
  - 1 V $ S S \ R 0$
  - OR
- MR hip arthrogram (1.5T)
  - 3 IV $ S S S \ R 0$

**Imaging: alternative recommendation**
- CT hip w/o contrast
  - 4 IV $ S S \ R 3$
- OR
- MRI hip w/o contrast
  - 1 II $ S S \ R 0$

**Significant positive result?**
- Yes → REFER to hip surgeon
- No → RE-EVALUATE diagnosis OR CONSIDER referral to hip specialist

**DECISION NODE #6 KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
PROVEN IMAGING FOR Hip Pain (HP)

DECISION NODE #7

Chronic HP + inflammatory or nonspecific arthropathy

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 1 $$ 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

provide additional care as clinically warranted

DECISION NODE #7 KEY EVIDENCE


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

LEGEND

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PROVEN IMAGING FOR Hip Pain (HP)

DECISION NODE #8

Chronic HP + mild osteoarthritis

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

no

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

DECISION NODE #8 KEY EVIDENCE


* Also appropriate as pre-operative planning tool

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

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**PROVEN IMAGING FOR Hip Pain (HP)**

**DECISION NODE #9**

**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

**AUC met (IF ALL)?**
- yes
  - Imaging: primary recommendation
    - MRI hip arthrogram
      - Level: 1
      - Evidence: II
      - RVUs: $$$
      - Dose: R0
    - OR
      - MRI hip w/o contrast (3T)
        - Level: 2
        - Evidence: II
        - RVUs: $$
        - Dose: R0
  - Imaging: alternative recommendation
    - CT hip arthrogram*
      - Level: 1
      - Evidence: II
      - RVUs: $$$
      - Dose: R3
- no
  - PROVIDE additional care as clinically warranted

**Significant positive result (IF ANY)?**
- yes
  - REFER to hip preservation surgeon
- no
  - MANAGE with conservative measures AND CONSIDER other causes for pain

*Also appropriate as pre-operative planning tool

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

---

**DECISION NODE #9 KEY EVIDENCE**


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**PROVEN IMAGING FOR Hip Pain (HP)**

**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

**Imaging: primary recommendation**
- MRI hip w/o contrast

**Significant positive result (IF ANY)?**
- Edema in or narrowing of the ischiofemoral/quadratus femoral spaces
- Inflammation of the sciatic nerve

**DECISION NODE #10 KEY EVIDENCE**


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

See abbreviations on page 2.
**PROVEN IMAGING FOR Hip Pain (HP)**

#### 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

**Imaging: primary recommendation**

- MRI hip w/o contrast

**Significant positive result?**
- Yes: Tear of the gluteus medius/minimus
- No: RE-EVALUATE diagnosis OR MANAGE with conservative measures

**Provide additional care as clinically warranted**

**DECISION NODE #11 KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**PROVEN IMAGING FOR Hip Pain (HP)**

**DECISION NODE #12**

**Chronic HP + suspected proximal hamstring tendinopathy**

- **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

- **Imaging: primary recommendation**
  - MRI hip w/o contrast
  - Level of Evidence: 2
  - Measure: S$\,$R0

- **Imaging: alternative recommendation**
  - CT hip w/o contrast
  - Level of Evidence: 5
  - Measure: S$\,$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**
    - PROVIDE additional care as clinically warranted
    - **no**
    - **RE-EVALUATE** diagnosis OR **MANAGE** with conservative measures

**DECISION NODE #12 KEY EVIDENCE**


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

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PROVEN IMAGING FOR **Hip Pain (HP)**

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**.

### DECISION NODE #13

**Acute HP + suspected acute hamstring tear**

**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

**Imaging: primary recommendation**

- **MRI hip w/o contrast**  
  - Level of Evidence: II  
  - Measure: $$ (0.01 - 5 RVUs) $$  
  - Dose: **R0** (0 mSv)

**Significant positive result?**

- **Avulsion of hamstring origin**  
  - Refer to hip surgeon

**no**

**PROVIDE additional care as clinically warranted**

### DECISION NODE #13 KEY EVIDENCE


(For a full list of references for all decision nodes, see bibliography on **pages 29 through 31**.)
DECISION NODE #14

**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

**Imaging: primary recommendation**

- MRI hip w/o contrast

**Imaging: alternative recommendation**

- CT hip w/o contrast

**Significant positive result?**

- yes → REFER to hip surgeon
- no → PROVIDE additional care as clinically warranted

**DECISION NODE #14 KEY EVIDENCE**


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

(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**DECISION NODE #15**

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

- **AUC met (IF ALL)?**
  - Yes
    - Imaging: primary recommendation
      - MRI hip w/o contrast
    - Imaging: alternative recommendation
      - CT hip w/o contrast
  - No
    - PROVIDE additional care as clinically warranted

**Significant positive result?**

- Yes
  - REFER to hip surgeon
- No
  - MANAGE with conservative measures

**DECISION NODE #15 KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
**PROVEN IMAGING FOR Hip Pain (HP)**

**DECISION NODE #16**

**Acute HP + suspected dislocation (post relocation)?**
- Yes
  - **Imaging: primary recommendation**
    - MRI hip w/o contrast (3 T) Level of Evidence 1VI $\$ R0
    - OR
    - MRI hip arthrogram (1.5 T) Level of Evidence 4II $$$ R0
  - If significant positive result (IF EITHER):
    - Osteochondral injury
    - Loose bodies

- No
  - **Imaging: alternative recommendation**
    - CT hip w/o contrast Level of Evidence 2II $\$ R3
  - PROVIDE additional care as clinically warranted

**DECISION NODE #16 KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
PROVEN IMAGING FOR **Hip Pain (HP)**

**DECISION NODE #17**

**Acute HP + suspected septic arthritis or osteomyelitis**

**AUC met (IF ALL)?**
- Atypical hip pain
- Constitutional symptoms
- Elevated ESR, CRP, or WBC
- Negative or noncontributory radiographs

**Imaging: primary recommendation**

- MRI hip w/ and w/o contrast
  - **Imaging: primary recommendation**
  - **significant positive result (IF EITHER)?**
    - **Osteomyelitis**
    - **Joint effusion with synovitis**

**Imaging: alternative recommendation**

- Bone scan

**DECISION NODE #17 KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 29 through 31.)
### TABLE 1. MRI hip without contrast appropriate use indications (PRIMARY recommendation)

<table>
<thead>
<tr>
<th>POST THA (IF ALL)</th>
<th>NOT POST THA (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ HP + suspected psoas irritation</td>
<td></td>
</tr>
<tr>
<td>□ Persistent anterior hip pain provoked by active hip flexion</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
</tr>
<tr>
<td>□ No radiographic evidence of hardware failure</td>
<td></td>
</tr>
<tr>
<td>□ Failed conservative treatment by a hip specialist</td>
<td></td>
</tr>
<tr>
<td>□ HP + suspected ischiofemoral impingement</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
</tr>
<tr>
<td>□ Primarily pain in posterior buttck/ischium</td>
<td></td>
</tr>
<tr>
<td>□ Painful sitting and walking</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs indicating narrowed ischiofemoral space</td>
<td></td>
</tr>
<tr>
<td>□ EITHER positive long stride OR ischiofemoral test</td>
<td></td>
</tr>
<tr>
<td>□ HP + suspected gluteus medius/minus tear</td>
<td></td>
</tr>
<tr>
<td>□ Absence of external snapping and advanced osteoarthritis</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
</tr>
<tr>
<td>□ Pain localized to the peri-trochanter</td>
<td></td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
<td></td>
</tr>
<tr>
<td>AND ANY ONE OR MORE OF THESE:</td>
<td></td>
</tr>
<tr>
<td>□ Trendelenburg gait</td>
<td></td>
</tr>
<tr>
<td>□ Pelvic drop during ipsilateral single-leg stand</td>
<td></td>
</tr>
<tr>
<td>□ Abductor weakness</td>
<td></td>
</tr>
<tr>
<td>□ Positive hip lag sign</td>
<td></td>
</tr>
<tr>
<td>□ Chronic HP + inflammatory or nonspecific arthropathy</td>
<td></td>
</tr>
<tr>
<td>□ Non specific hip pain</td>
<td></td>
</tr>
<tr>
<td>□ Limited hip range of motion</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
<td></td>
</tr>
<tr>
<td>□ Positive lab workup for inflammatory arthritis</td>
<td></td>
</tr>
<tr>
<td>□ Chronic HP + mild osteoarthritis</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
</tr>
<tr>
<td>□ Primarily deep anterior hip pain</td>
<td></td>
</tr>
<tr>
<td>□ Positive FADDIR and/or FABER</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
<td></td>
</tr>
<tr>
<td>□ Chronic HP + suspected femoral acetabular impingement or labrum tear</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
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<tr>
<td>□ Primarily deep anterior hip pain</td>
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<tr>
<td>□ Positive FADDIR and/or FABER</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
<td></td>
</tr>
<tr>
<td>□ Chronic HP + suspected ischiofemoral impingement</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
</tr>
<tr>
<td>□ Primarily pain in posterior buttck/ischium</td>
<td></td>
</tr>
<tr>
<td>□ Painful sitting and walking</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs indicating narrowed ischiofemoral space</td>
<td></td>
</tr>
<tr>
<td>□ EITHER positive long stride OR ischiofemoral test</td>
<td></td>
</tr>
<tr>
<td>□ Chronic HP + suspected gluteus medius / minimus tear</td>
<td></td>
</tr>
<tr>
<td>□ Absence of external snapping and advanced osteoarthritis</td>
<td></td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
<td></td>
</tr>
<tr>
<td>□ Pain localized to the peri-trochanter</td>
<td></td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
<td></td>
</tr>
<tr>
<td>□ Acute HP + suspected acute hamstring tear</td>
<td></td>
</tr>
<tr>
<td>□ Positive mechanism of injury with a painful pop</td>
<td></td>
</tr>
<tr>
<td>□ Bruising posterior thigh</td>
<td></td>
</tr>
<tr>
<td>□ Hamstring weakness</td>
<td></td>
</tr>
<tr>
<td>□ Difficulty with weight bearing</td>
<td></td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
<td></td>
</tr>
<tr>
<td>□ Acute HP + suspected avulsion fracture</td>
<td></td>
</tr>
<tr>
<td>□ Positive mechanism of injury with a painful pop or bruising</td>
<td></td>
</tr>
<tr>
<td>□ Associated muscle weakness</td>
<td></td>
</tr>
<tr>
<td>□ Difficulty with weight bearing</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs positive or equivocal for avulsion fracture</td>
<td></td>
</tr>
<tr>
<td>□ Acute HP + suspected stress fracture (femoral head/neck)</td>
<td></td>
</tr>
<tr>
<td>□ Acute groin pain</td>
<td></td>
</tr>
<tr>
<td>□ Positive single-leg hop test</td>
<td></td>
</tr>
<tr>
<td>□ Painful and weak hip flexion</td>
<td></td>
</tr>
<tr>
<td>□ Negative impingement testing</td>
<td></td>
</tr>
<tr>
<td>□ Painful weight-bearing</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs positive or equivocal for avulsion fracture</td>
<td></td>
</tr>
<tr>
<td>□ Acute HP + suspected dislocation, post-relocation</td>
<td></td>
</tr>
<tr>
<td>□ Positive mechanism of injury</td>
<td></td>
</tr>
<tr>
<td>□ Persistent pain</td>
<td></td>
</tr>
<tr>
<td>□ Limited hip motion</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs have been performed to ensure proper reduction</td>
<td></td>
</tr>
</tbody>
</table>

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

See abbreviations on page 2.
## TABLE 2. MRI hip without contrast appropriate use indications (ALTERNATIVE recommendation)

<table>
<thead>
<tr>
<th>POST THA (IF ALL)</th>
<th>NOT POST THA (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ HP + suspected hardware failure</td>
<td>□ Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis</td>
</tr>
<tr>
<td>□ Hip and thigh pain</td>
<td>□ Nonspecific hip pain</td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
<td>□ Painful limited hip range of motion</td>
</tr>
<tr>
<td>□ Equivocal CT</td>
<td>□ Radiographs inconclusive</td>
</tr>
<tr>
<td></td>
<td>□ Antalgic gait</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>POST THA (IF ALL)</th>
<th>NOT POST THA (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ HP + suspected infection</td>
<td>□ Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis</td>
</tr>
<tr>
<td>□ Pain or constitutional symptoms</td>
<td>□ Nonspecific hip pain</td>
</tr>
<tr>
<td>□ Positive lab results (WBC, ESR, CRP)</td>
<td>□ Painful limited hip range of motion</td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
<td>□ Antalgic gait</td>
</tr>
<tr>
<td></td>
<td>□ Radiographs inconclusive</td>
</tr>
<tr>
<td>□ Chronic HP + inflammatory or nonspecific arthropathy (depending on expertise)</td>
<td></td>
</tr>
<tr>
<td>□ Nonspecific hip pain</td>
<td></td>
</tr>
<tr>
<td>□ Limited hip range of motion</td>
<td></td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
<td></td>
</tr>
<tr>
<td>□ Positive lab workup for inflammatory arthritis</td>
<td></td>
</tr>
<tr>
<td>□ Acute HP + suspected septic arthritis or osteomyelitis</td>
<td></td>
</tr>
<tr>
<td>□ Atypical hip pain</td>
<td></td>
</tr>
<tr>
<td>□ Constitutional symptoms</td>
<td></td>
</tr>
<tr>
<td>□ Elevated ESR, CRP, or WBC</td>
<td></td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 4. MRI hip arthrogram appropriate use indications (PRIMARY recommendation)

<table>
<thead>
<tr>
<th>NOT POST THA (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Chronic HP + suspected avascular necrosis (AVN) or osteonecrosis</td>
</tr>
<tr>
<td>□ Nonspecific hip pain</td>
</tr>
<tr>
<td>□ Painful limited hip range of motion</td>
</tr>
<tr>
<td>□ Antalgic gait</td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
</tr>
<tr>
<td>□ Chronic HP + mild osteoarthritis</td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
</tr>
<tr>
<td>□ Primarily deep anterior hip pain</td>
</tr>
<tr>
<td>□ Positive FADDIR and/or FABER</td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
</tr>
<tr>
<td>□ Chronic HP + suspected femoral acetabular impingement or labrum tear</td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
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<tr>
<td>□ Primarily deep anterior hip pain</td>
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<tr>
<td>□ Positive FADDIR and/or FABER</td>
</tr>
<tr>
<td>□ Radiographs inconclusive</td>
</tr>
<tr>
<td>□ Acute HP + suspected dislocation, post-relocation</td>
</tr>
<tr>
<td>□ Positive mechanism of injury</td>
</tr>
<tr>
<td>□ Persistent pain</td>
</tr>
<tr>
<td>□ Limited hip motion</td>
</tr>
<tr>
<td>□ Radiographs have been performed to ensure proper reduction</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>POST THA (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ HP + suspected hardware failure</td>
</tr>
<tr>
<td>□ Hip and thigh pain</td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>POST THA (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ HP + suspected infection</td>
</tr>
<tr>
<td>□ Pain or constitutional symptoms</td>
</tr>
<tr>
<td>□ Positive lab results (WBC, ESR, CRP)</td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
</tr>
</tbody>
</table>
### TABLE 7. CT hip without contrast appropriate use indications (ALTERNATIVE recommendation)

<table>
<thead>
<tr>
<th>POST THA (IF ALL)</th>
<th>NOT POST THA (IF ALL)</th>
</tr>
</thead>
</table>
| □ HP + suspected gluteus medius / minimus tear  
  □ 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  | □ 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  | □ 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  |
| □ 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 + suspected dislocation, post-relocation  
  □ Positive mechanism of injury  
  □ Persistent pain  
  □ Limited hip motion  
  □ Radiographs have been performed to ensure proper reduction  |
| □ Chronic HP + mild osteoarthritis (also appropriate as pre-operative planning tool)  
  □ Symptoms > 3 months  
  □ Primarily deep anterior hip pain  
  □ Positive FADDIR and/or FABER  | □ 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  |
### TABLE 8. CT arthrogram appropriate use indications (ALTERNATIVE recommendation)

<table>
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<tr>
<th>NOT POST THA (IF ALL)</th>
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</thead>
<tbody>
<tr>
<td>□ Chronic HP + suspected femoral acetabular impingement or labrum tear</td>
</tr>
<tr>
<td>□ Symptoms &gt; 3 months</td>
</tr>
<tr>
<td>□ Primarily deep anterior hip pain</td>
</tr>
<tr>
<td>□ Positive FADDIR and/or FABER</td>
</tr>
<tr>
<td>□ Negative or noncontributory radiographs</td>
</tr>
</tbody>
</table>

### TABLE 9. Bone scan appropriate use indications (ALTERNATIVE recommendation)

<table>
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<tr>
<th>POST THA (IF ALL)</th>
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<tr>
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<tr>
<td>□ Negative or noncontributory radiographs</td>
<td></td>
</tr>
<tr>
<td>□ Equivocal CT</td>
<td></td>
</tr>
<tr>
<td>□ Acute HP + suspected septic arthritis or osteomyelitis (at the discretion of the hip surgeon)</td>
<td></td>
</tr>
<tr>
<td>□ Atypical hip pain</td>
<td></td>
</tr>
<tr>
<td>□ Constitutional symptoms</td>
<td></td>
</tr>
<tr>
<td>□ Elevated ESR, CRP, or WBC</td>
<td></td>
</tr>
<tr>
<td>□ No significant positive finding on MRI</td>
<td></td>
</tr>
</tbody>
</table>
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 Proven Imaging 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 Proven Imaging CPMs and supporting materials, visit: https://intermountainhealthcare.org/services/imaging-services/proven-imaging/.

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
**BIBLIOGRAPHY**

**NODE #1**

**NODE #2**

**NODE #3**

**NODE #4**


NODE #5


NODE #6


NODE #7


NODE #8


NODE #9

**BIBLIOGRAPHY, CONTINUED**


**NODE #10**


**NODES #11 – 13**


**NODES #14 – 16**


**NODE #17**


REFERENCES (from pages 1 through 3)


