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 in order 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.\textsuperscript{SMR} The inflating costs of advanced imaging outstripped that of any other medical service.\textsuperscript{IGLE, GAO} These inflating costs resulted in up to $20–30 billion in unnecessary advanced imaging spending each year.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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 Proven Imaging approach seeks to avoid these risks.

GOALS AND MEASURES

This CPM was developed by Intermountain clinical experts to outline appropriate use criteria (AUC) for advanced imaging for low back 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
- 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

Indicates an Intermountain measure
PROVEN IMAGING FOR Low Back Pain (LBP)

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 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 pages 5 through 16). 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 ordering of an imaging study. Point-of-order checklists are also included (beginning on page 17). 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 RVUs published by 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:

1. The 2011 revision of the Oxford Centre for Evidence-Based Medicine (OCEMB) 2011 Levels of Evidence standard. This standard includes categorical levelling 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 (pairing of AUC and recommended / alternative tests).

Using the algorithms and checklists

Under “Care Pathway” 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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>ankylosing spondylosis</td>
</tr>
<tr>
<td>CPG</td>
<td>clinical practice guideline</td>
</tr>
<tr>
<td>CPM</td>
<td>care process model</td>
</tr>
<tr>
<td>CT</td>
<td>computed tomography</td>
</tr>
<tr>
<td>DISH</td>
<td>diffuse idiopathic skeletal hyperostosis</td>
</tr>
<tr>
<td>eGFR</td>
<td>glomerular filtration rate</td>
</tr>
<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
</tr>
<tr>
<td>PCP</td>
<td>primary care provider</td>
</tr>
<tr>
<td>PM&amp;R</td>
<td>pain management and rehabilitation</td>
</tr>
</tbody>
</table>

Note: OCEMB, Fryback, and Thornbury are references used for evidence-based medicine and imaging.
## PROVEN IMAGING FOR Low Back Pain (LBP)

### Care pathways

For each clinical scenario included (e.g., low back pain plus suspected cancer), 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 that performing neuroimaging studies for chronic but stable low back pain (i.e., no new features and normal neurologic exam) is not recommended.**

This page presents the elements of the care pathway below and key information provided in each test recommendation box at right. There is a legend at the bottom of each care pathway page.

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).

---

**DECISION NODE #6**

**LBP + suspected cancer**

- **AUC met (IF ANY)?**
  - History of cancer
  - Multiple cancer risk factors
  - Strong clinical suspicion

- **Imaging: primary recommendation**
  - MRI lumbar spine w/ and w/o contrast (based on location)
  - 1
  - II
  - $ R0

- **Imaging: alternative recommendation**
  - CT lumbar spine w/ and w/o contrast
  - 1
  - II
  - $ R3

- **Significant positive result?**
  - Yes
    - Evidence of neoplasm
    - Mass effect on nerve/root/spinal canal
    - Instability
  - No

- **CONSULT** with oncology

- **CONSULT** with neurosurgery (URGENT)

- **FOLLOW UP** in 1 to 2 weeks

- **Clinical suspicion still high?**
  - Yes
    - REFER to oncology
  - No

---

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

- $ = 0 – 5 RVU
- $$ = 5 – 10 RVU
- $$$ = 10 – 15 RVU
- $$$$ = 15+ RVU

**Radiation risk rankings** use the scale developed by the American College of Radiology (ACR). 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

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

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

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

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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 17 through 19 indicate if the test is a primary recommendation or alternative recommendation.

### TABLE 2. MRI lumbar spine* WITH AND WITHOUT CONTRAST appropriate use indications

<table>
<thead>
<tr>
<th>PRIMARY recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ LBP without improvement + prior lumbar surgery (NO suspicion of hardware failure) (IF ANY):</td>
</tr>
<tr>
<td>□ Worsening back pain</td>
</tr>
<tr>
<td>□ New or acute radiculopathy</td>
</tr>
<tr>
<td>□ Weakness</td>
</tr>
<tr>
<td>□ High suspicion for disc disease adjacent to hardware</td>
</tr>
<tr>
<td>□ LBP + suspected cancer (IF ANY)</td>
</tr>
<tr>
<td>□ History of cancer</td>
</tr>
<tr>
<td>□ Multiple cancer risk factors</td>
</tr>
<tr>
<td>□ Strong clinical suspicion</td>
</tr>
<tr>
<td>□ LBP + suspected infection (IF ANY)</td>
</tr>
<tr>
<td>□ Fever/chills and/or pain with rest or at night</td>
</tr>
<tr>
<td>□ Other risk factors**</td>
</tr>
</tbody>
</table>

* Or C or T spine based on location
** Other risk factors (e.g., immunocompromised patient, UTI, IV drug use, recent spinal procedure)
**PROVEN IMAGING FOR Low Back Pain (LBP)**

## LOW BACK PAIN (LBP) CARE PATHWAY ALGORITHMS

### DECISION NODE #1

**LBP without complicating features**

**AUC met (IF ALL)?**

- 3 months of symptoms and adequate conservative treatment* with no improvement

**Imaging:**

- **primary recommendation:** MRI lumbar spine w/o contrast
  - Level of Evidence: II
  - Intermountain Measure: $ (0 – 5 RVUs)
  - Radiation dose: R0 (0 mSv)
- **alternative recommendation:** CT lumbar spine w/o contrast
  - Level of Evidence: II
  - Intermountain Measure: $ (5 – 10 RVUs)
  - Radiation dose: R3 (1 – 10 mSv)

**Significant positive result?**

- Yes
  - Severe stenosis
  - Nerve root compression
  - Instability
  - Mass
  - Fracture
- No

**CONTINUE** conservative measures AND CONSIDER referral to multidisciplinary spine center

**REFER** to ortho/neuro spine surgeon

OR

non-operative spine surgeon (PM&R/pain management physician)

**REFER** to Low Back Pain CPM (or other system-wide protocol)

---

### DECISION NODE #1 KEY EVIDENCE


* Requires claim for either:
  - PT/chiropractic evaluation in preceding 60 days
  - Follow-up evaluation and management between 28 and 60 days preceding MRI

(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
## PROVEN IMAGING FOR Low Back Pain (LBP)

### DECISION NODE #2A KEY EVIDENCE

<table>
<thead>
<tr>
<th>Clinical Scenario</th>
<th>RO (0 mSv)</th>
<th>R3 (1–10 mSv)</th>
<th>R4 (10–30 mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgent or Emergency Situation</td>
<td>$ (0–5 RVUs)</td>
<td>$S$ (5–10 RVUs)</td>
<td>$SS$ (10–15 RVUs)</td>
</tr>
</tbody>
</table>

### LBP + weakness (cauda equina syndrome and/or lower motor neuron symptoms)

- **Suspected cauda equina syndrome (signs/symptoms):**
  - New bowel or bladder dysfunction
  - Perineal numbness/saddle anesthesia
  - Persistent/increasing lower extremity weakness, numbness, or tingling

- **OR IF**
  - Sudden onset/rapidly progressive flaccid weakness (lower motor neuron symptoms)

#### EMERGENCY REFERRAL OR emergency spine consult

**Significant positive result?**
- Severe stenosis
- Compression of cauda equina
- Large disc herniation

**CONSIDER (BOTH):**
- Clinical alternatives (demyelinating disease and intracranial pathology)
- Referral/consultation with neurology or neurosurgery

**Imaging: primary recommendation**
- MRI lumbar spine w/o contrast
- Level of Evidence: II
- Intermountain Measure: $R0$

**Imaging: alternative recommendation**
- CT myelogram lumbar spine
- Level of Evidence: II
- Intermountain Measure: $$$R3$

**DECISION NODE #2A**

- AUC met (IF ANY)?
  - Suspected cauda equina syndrome (signs/symptoms):
    - New bowel or bladder dysfunction
    - Perineal numbness/saddle anesthesia
    - Persistent/increasing lower extremity weakness, numbness, or tingling
  - OR IF
    - Sudden onset/rapidly progressive flaccid weakness (lower motor neuron symptoms)

- For upper motor, see Decision Node #2B on page 7

(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)


**PROVEN IMAGING FOR Low Back Pain (LBP)**

**DECISION NODE #2B**

- **AUC met (IF ANY)?**
  - Myelopathy / upper motor neuron symptoms:
    - Hyperreflexia / Hoffman’s sign
    - New-onset Babinski or clonus
    - New onset gait / balance abnormalities
    - Upper and lower extremity weakness
  - Yes ➔ **EMERGENCY REFERRAL**
    - Emergency spine consult if high suspicion
  - No ➔ REFER to either Low Back Pain CPM OR Low Back Pain in the ED CPM (or other system-wide protocol)

- **Imaging: primary recommendation**
  - MRI spine (C, T, L) w/o contrast
    - Level of Evidence: 2
    - RVUs: $$$
    - Dose: R0
  - MRI brain w/o contrast
    - Level of Evidence: 2
    - RVUs: $3
    - Dose: R0

- **Imaging: alternative recommendation**
  - CT myelogram spine (C, T, L)
    - Level of Evidence: 2
    - RVUs: $$$
    - Dose: R4
  - CT brain / head w/ and w/o contrast
    - Level of Evidence: 2
    - RVUs: $1
    - Dose: R3

**DECISION NODE #2B KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
PROVEN IMAGING FOR Low Back Pain (LBP)

DECISION NODE #3

LBP + suspected compression fracture

- AUC met?
  - Osteoporosis / osteoporosis risk AND EITHER
    - Negative lumbar spine radiographs with high suspicion of compression fracture
    - OR
      - Age-indeterminate compression on radiograph
  - yes
    - Imaging: primary recommendation
      - MRI lumbar spine w/o contrast
      - Imaging: alternative recommendation
        - CT lumbar spine w/o contrast
  - no
    - REFER to Low Back Pain CPM (or other system-wide protocol)

If yes:

- Significant positive result?
  - Unstable compression fracture
    - REFER to ortho / neuro spine surgeon (URGENT)
  - Stable compression fracture
    - REFER to non-operative spine specialist (PM&R / pain management physician)
  - (IF not improved) CONSIDER referral to non-operative spine specialist (PM&R / pain management physician)

If no:

- MANAGE with conservative measures per Low Back Pain CPM (or other system-wide protocol) for 2–4 weeks

DECISION NODE #3 KEY EVIDENCE


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)

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PROVEN IMAGING FOR Low Back Pain (LBP)

DECISION NODE #4A-1

AUC met? Significant trauma

yes

EMERGENCY trauma evaluation

no

Imaging: primary recommendation

CT lumbar spine w/o contrast

1

III

R3

DECISION NODE #4A-2

AUC met (IF ANY)?

• High suspicion of ligamentous injury

• Persistent neurologic deficit

yes

Imaging: primary recommendation

MRI lumbar spine w/o contrast

2

II

R0

no

MANAGE in the ED per clinical judgement

DECISION NODE #4A KEY EVIDENCE


For a full list of references for all decision nodes, see bibliography on pages 21 through 24.

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**DECISION NODE #4B**

**AUC met?**
- Mild/moderate trauma (WITH ANY OF THE FOLLOWING):
  - Questionable lumbar spine radiograph findings
  - Inadequate anatomical coverage on radiograph
  - High clinical suspicion in high-risk patient with known spondyloarthropathy (e.g., AS or DISH)

**URGENT care or PCP evaluation**

**Imaging: primary recommendation**
- CT lumbar spine w/o contrast
  - 3 II $ R3

**Significant positive result (IF ANY)?**
- Fractures except isolated transverse process fractures (may not be urgent)
- Evidence of ligamentous injury
- Hematoma
- Instability
- Acute disc herniation / nerve compression

**REFER to ortho / neuro spine surgeon (URGENT)**

See abbreviations on page 2.

---

**DECISION NODE #4C**

**AUC met (IF ALL)?**
- Known spondyloarthropathy (AS or DISH)
- High suspicion of injury
- Negative CT findings

**URGENT care or PCP evaluation**

**Imaging: primary recommendation**
- MRI lumbar spine w/o contrast
  - 3 II $ R0

**Significant positive result?**
- Fractures except isolated transverse process fractures (may not be urgent)
- Evidence of ligamentous injury
- Hematoma
- Instability
- Acute disc herniation / nerve compression

**FOLLOW UP (nonsurgical) in 1–2 weeks**


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
**DECISION NODE #5A**

**LBP without improvement + prior lumbar surgery (NO suspicion of hardware failure)**

- **AUC met (IF ANY)?**
  - Worsening back pain
  - New or acute radiculopathy
  - Weakness
  - High suspicion for disc disease adjacent to hardware

- **URGENT SPINE SURGERY REFERRAL if radiculopathy with weakness/disabling**
  - Spinal stenosis
  - Disease adjacent to hardware
  - Acute/new disc herniation
  - Infection

- **Imaging: primary recommendation**
  - MRI lumbar spine w/ and w/o contrast

- **Significant positive result?**
  - yes → REFER to ortho/neuro spine surgeon
  - no → **REFER** to the Low Back Pain CPM or other system-wide protocol

- **MANAGE** with conservative measures per Low Back Pain CPM or other system-wide protocol for 3 months

- **(IF not improved)** CONSIDER referral to ortho/neuro spine surgeon or multidisciplinary spine center

---

**DECISION NODE #5A KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
**PROVEN IMAGING FOR Low Back Pain (LBP)**

**DECISION NODE #5B**

- **AUC met (IF ALL)?**
  - Back pain with suspicion of hardware failure
  - Negative lumbar spine radiograph with flex/ex lateral + AP/lateral
  - Equivocal plain film findings

**Imaging: primary recommendation**
- CT lumbar spine w/o contrast

**Significant positive result?**
- Halo around screws
- Evidence of incomplete or failed fusion
- New fractures

- **yes** → REFER to ortho/neuro spine surgeon
- **no** → REFER to either Low Back Pain CPM (or other system-wide protocol)

**MANAGE with conservative measures per Low Back Pain CPM (or other system-wide protocol) for 3 months**

**DECISION NODE #5B KEY EVIDENCE**


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
PROVEN IMAGING FOR Low Back Pain (LBP)

DECISION NODE #6

- **AUC met (IF ANY)?**
  - **yes**
    - **Imaging: primary recommendation**
      - MRI lumbar spine w/ and w/o contrast (based on location)
      - Level of Evidence: II
      - RVUs: $\$\$
      - Radiation: R0 (0 mSv)
    - **Imaging: alternative recommendation**
      - CT lumbar spine w/ and w/o contrast
      - Level of Evidence: II
      - RVUs: $\$\$
      - Radiation: R4 (10–30 mSv)
  - **no**

- **Clinical suspicion still high?**
  - **yes**
    - **CONSULT** with oncology
  - **no**

**CONSULT with neurosurgery (URGENT)**

**CONSULT** with oncology

**FOLLOW UP** in 1 to 2 weeks

**REFER** to oncology

**REFER to either Low Back Pain CPM (or other system-wide protocol)**

DECISION NODE #6 KEY EVIDENCE


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
PROVEN IMAGING FOR Low Back Pain (LBP)

DECISION NODE #7

LBP + suspected infection

AUC met (IF ANY)?
- Fever/chills and/or pain with rest or at night
- Other risk factors*

yes → Imaging: primary recommendation
MRI lumbar spine w/ and w/o contrast (based on location)
[ ] Level of Evidence: II
[ ] OCEBM:
[ ] Intermountain Measure $ (0 – 5 RVUs)
[ ] $$$ (10 – 15 RVUs)
[ ] $$$$ (15+ RVUs)

no → Imaging: alternative recommendation
CT lumbar spine w/ and w/o contrast
[ ] Level of Evidence: II
[ ] OCEBM:
[ ] Intermountain Measure $ (0 – 5 RVUs)
[ ] $$$ (5 – 10 RVUs)
[ ] $$$$ (10 – 15 RVUs)

yes → Significant positive result?
- Epidural abscess
- Phlegmon with mass effect on nerve root/spinal canal
- Instability

yes → CONSULT with neurosurgery and/or spine surgery (EMERGENCY)

no → Significant positive result?
- Osteomyelitis/discitis

yes → REFER to infectious disease

FOLLOW UP in 1 to 2 weeks

no → Clinical suspicion still high?

yes → REFER to either Low Back Pain CPM (or other system-wide protocol)

* Other risk factors include immuno-compromised patient, UTI, IV drug use, recent spinal procedure.

DECISION NODE #7 KEY EVIDENCE


See abbreviations on page 2.

(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
DECISION NODE #8

LBP + suspected spondylolysis*

AUC met (IF ANY)?
- Pain with standing, walking, extension
- Negative lumbar spine radiograph and high suspicion
- Lower extremity weakness

yes → Imaging: primary recommendation

CT lumbar spine w/o contrast (limit coverage to area of interest, usually L5/S1)

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Fryback &amp; Thornbury Level of Evidence</th>
<th>Intermountain Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>II</td>
<td>$</td>
</tr>
</tbody>
</table>

$ (0 – 5 RVUs)
$ $ (5 – 10 RVUs)
$ $ $ (10 – 15 RVUs)
$ $ $ $ (15+ RVUs)

R0 (0 mSv)
R 3 (1 – 10 mSv)
R 4 (10 – 30 mSv)

yes → Significant positive result?

Symptomatic spondylolysis (≥ 4 mm)

no → Refer to either Low Back Pain CPM (or other system-wide protocol)

no → Refer to ortho/neuro spine surgeon

MANAGE with conservative measures per Low Back Pain CPM (or other system-wide protocol) for 3 months + (IF not improved) CONSIDER referral to sports medicine or multidisciplinary spine center

DECISION NODE #8 KEY EVIDENCE

* Occurs most often in those age < 20 and in athletes and dancers.


(For a full list of references for all decision nodes, see bibliography on pages 21 through 24.)
**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 lumbar spine* WITHOUT CONTRAST appropriate use indications

(PRIMARY recommendation)

<table>
<thead>
<tr>
<th>□ LBP without complicating features (IF ALL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ [ ] ≥ 3 months of symptoms</td>
</tr>
<tr>
<td>□ [ ] Adequate conservative therapy** with no improvement</td>
</tr>
<tr>
<td>□ LBP + weakness: Cauda equina syndrome and/or lower motor neuron symptoms (IF ANY)</td>
</tr>
<tr>
<td>□ [ ] New bowel or bladder dysfunction</td>
</tr>
<tr>
<td>□ [ ] Perineal numbness/saddle anesthesia</td>
</tr>
<tr>
<td>□ [ ] Persistent/increasing lower extremity weakness, numbness, or tingling</td>
</tr>
<tr>
<td>OR IF</td>
</tr>
<tr>
<td>□ [ ] Sudden onset/rapidly progressive flaccid weakness (lower motor neuron symptoms)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>□ LBP + weakness: Myelopathy/upper motor neuron symptoms (IF ANY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ [ ] Hyperreflexia/Hoffman’s sign</td>
</tr>
<tr>
<td>□ [ ] New-onset Babinski or clonus</td>
</tr>
<tr>
<td>□ [ ] New onset gait/balance abnormalities</td>
</tr>
<tr>
<td>□ [ ] Upper and lower extremity weakness</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>□ Suspected compression fracture (IF ANY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ [ ] Osteoporosis/osteoporosis risk</td>
</tr>
<tr>
<td>AND EITHER</td>
</tr>
<tr>
<td>□ [ ] Negative lumbar spine radiographs with high suspicion of compression fracture OR</td>
</tr>
<tr>
<td>□ [ ] Age-indeterminate compression on radiograph</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>□ LBP + significant trauma in the ED setting:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ [ ] No significant positive on CT lumbar spine</td>
</tr>
<tr>
<td>AND EITHER:</td>
</tr>
<tr>
<td>□ [ ] High suspicion of ligamentous injury</td>
</tr>
<tr>
<td>OR</td>
</tr>
<tr>
<td>□ [ ] Persistent neurologic deficit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>□ LBP + mild/moderate trauma in any setting (IF ALL):</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ [ ] Known spondyloarthropathy (AS or DISH)</td>
</tr>
<tr>
<td>□ [ ] High suspicion of injury</td>
</tr>
<tr>
<td>□ [ ] Negative CT findings</td>
</tr>
</tbody>
</table>

* Or C or T spine based on location

** Requires claim for either: PT/chiropractic evaluation in preceding 60 days OR follow-up evaluation and management between 28 and 60 days preceding MRI

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## POINT-OF-ORDER CHECKLISTS, CONTINUED

### TABLE 2. MRI lumbar spine* WITH AND WITHOUT CONTRAST appropriate use indications

<table>
<thead>
<tr>
<th>(PRIMARY recommendation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP without improvement + prior lumbar surgery (NO suspicion of hardware failure) (IF ANY):</td>
</tr>
<tr>
<td>□ Worsening back pain</td>
</tr>
<tr>
<td>□ New or acute radiculopathy</td>
</tr>
<tr>
<td>□ Weakness</td>
</tr>
<tr>
<td>□ High suspicion for disc disease adjacent to hardware</td>
</tr>
<tr>
<td>LBP + suspected cancer (IF ANY)</td>
</tr>
<tr>
<td>□ History of cancer</td>
</tr>
<tr>
<td>□ Multiple cancer risk factors</td>
</tr>
<tr>
<td>□ Strong clinical suspicion</td>
</tr>
<tr>
<td>LBP + suspected infection (IF ANY)</td>
</tr>
<tr>
<td>□ Fever / chills and / or pain with rest or at night</td>
</tr>
<tr>
<td>□ Other risk factors**</td>
</tr>
</tbody>
</table>

* Or C or T spine based on location
** Other risk factors (e.g., immunocompromised patient, UTI, IV drug use, recent spinal procedure)

### TABLE 3. MRI brain WITHOUT CONTRAST appropriate use indications

<table>
<thead>
<tr>
<th>(PRIMARY recommendation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP + weakness: Myelopathy / upper motor neuron symptoms (IF ANY)</td>
</tr>
<tr>
<td>□ Hyperreflexia / Hoffman’s sign</td>
</tr>
<tr>
<td>□ New-onset Babinski or clonus</td>
</tr>
<tr>
<td>□ New onset gait / balance abnormalities</td>
</tr>
<tr>
<td>□ Upper and lower extremity weakness</td>
</tr>
</tbody>
</table>

See abbreviations on page 2.
## TABLE 4. CT lumbar spine* WITHOUT CONTRAST appropriate use indications

### (PRIMARY recommendation)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP + significant trauma (in the ED setting)</td>
<td></td>
</tr>
<tr>
<td>LBP + mild/moderate trauma in any setting (WITH ANY OF THE FOLLOWING):</td>
<td></td>
</tr>
<tr>
<td>Questionable lumbar spine radiograph findings</td>
<td></td>
</tr>
<tr>
<td>Inadequate anatomical coverage on radiograph</td>
<td></td>
</tr>
<tr>
<td>High clinical suspicion in high-risk patient with known spondyloarthropathy (e.g., AS or DISH)</td>
<td></td>
</tr>
<tr>
<td>LBP + prior lumbar surgery (with suspicion of hardware failure) (IF ALL):</td>
<td></td>
</tr>
<tr>
<td>Back pain with clinical concern for hardware failure</td>
<td></td>
</tr>
<tr>
<td><strong>AND EITHER:</strong></td>
<td></td>
</tr>
<tr>
<td>Negative lumbar spine radiograph with flex/ex lateral + AP/lateral OR</td>
<td></td>
</tr>
<tr>
<td>Equivocal plain film findings</td>
<td></td>
</tr>
<tr>
<td>LBP + suspected spondylolysis (IF ANY)**</td>
<td></td>
</tr>
<tr>
<td>Pain with standing, walking, extension</td>
<td></td>
</tr>
<tr>
<td>Negative lumbar spine radiograph and high suspicion</td>
<td></td>
</tr>
<tr>
<td>Lower extremity weakness</td>
<td></td>
</tr>
</tbody>
</table>

### (ALTERNATIVE recommendation)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP without complicating features (IF ALL)</td>
<td></td>
</tr>
<tr>
<td>≥3 months of symptoms</td>
<td></td>
</tr>
<tr>
<td>Adequate conservative therapy*** with no improvement</td>
<td></td>
</tr>
<tr>
<td>Suspected compression fracture (IF ANY)</td>
<td></td>
</tr>
<tr>
<td>Osteoporosis/osteoporosis risk **</td>
<td></td>
</tr>
<tr>
<td><strong>AND EITHER</strong></td>
<td></td>
</tr>
<tr>
<td>Negative lumbar spine radiographs with high suspicion of compression fracture</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Age-indeterminate compression on radiograph</td>
<td></td>
</tr>
</tbody>
</table>

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* Or C or T spine based on location

** Limit coverage to area of interest, usually L5/S1.

*** Requires claim for either: PT/chiropractic evaluation in preceding 60 days OR follow-up evaluation and management between 28 and 60 days preceding MRI.
TABLE 5. CT lumbar* spine WITH and WITHOUT CONTRAST appropriate use indications

(ALTERNATIVE recommendation)

☐ LBP + suspected cancer (IF ANY)
  ☐ History of cancer
  ☐ Multiple cancer risk factors
  ☐ Strong clinical suspicion

☐ LBP + suspected infection (IF ANY)
  ☐ Fever/chills and/or pain with rest or at night
  ☐ Other risk factors**

* Or C or T spine based on location
** Other risk factors (e.g., immunocompromised patient, UTI, IV drug use, recent spinal procedure)

TABLE 6. CT myelogram* appropriate use indications

(ALTERNATIVE recommendation)

☐ LBP + weakness: Cauda equina syndrome and/or sudden onset lower motor symptoms (IF ANY)
  ☐ New bowel or bladder dysfunction
  ☐ Perineal numbness/saddle anesthesia
  ☐ Persistent/increasing lower extremity weakness, numbness, or tingling
  ☐ Sudden onset/rapidly progressive flaccid weakness (lower motor)

☐ LBP + weakness: Myelopathy/upper motor neuron symptoms (IF ANY)
  ☐ Hyperreflexia/Hoffman’s sign
  ☐ New-onset Babinski or clonus
  ☐ New onset gait/balance abnormalities
  ☐ Upper and lower extremity weakness

* Or C/T/L spine based on location

TABLE 7. CT brain/head WITH AND WITHOUT CONTRAST appropriate use indications

(ALTERNATIVE recommendation)

☐ LBP + weakness: Myelopathy/upper motor neuron symptoms (IF ANY)
  ☐ Hyperreflexia/Hoffman’s sign
  ☐ New-onset Babinski or clonus
  ☐ New onset gait/balance abnormalities
  ☐ Upper and lower extremity weakness
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:
- Low Back Pain
- Lumbar Spinal Fusion (posterior)
- Spinal Nerve Decompression
- Discography

Fact sheets:
- CT Scan
- Radiation Exposure in Medical Tests
- Intravenous (IV) Contrast Material
- Spine Injury and Orthotic Braces

Patient education:
- Spine Guide
- Managing Chronic Pain
- Pain Med Tracking Sheet

Related Care Process Models (CPMs):
- Low Back Pain CPM
- Prescribing Opioids for Chronic Pain CPM
- Imaging Radiation Exposure CPM
**PROVEN IMAGING FOR Low Back Pain (LBP)**

**BIBLIOGRAPHY**

**NODE #1**


**NODE #2**


PROVEN IMAGING FOR Low Back Pain (LBP)

BIBLIOGRAPHY, CONTINUED

NODE #3


NODE #4B – #4C


BIBLIOGRAPHY, CONTINUED


NODE #5


NODES #6 – 7


NODE #8


REFERENCES (from pages 1 and 2)


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. Send feedback to ProvenImaging@imail.org.