

MedSolutions, Inc.
Clinical Decision Support Tool
Diagnostic Strategies

This tool addresses common symptoms and symptom complexes. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or patient's Primary Care Physician (PCP) may provide additional insight.

PEDIATRIC AND CONGENITAL IMAGING GUIDELINES
MUSCULOSKELETAL
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MedSolutions, Inc. Clinical Decision Support Tool
for Advanced Diagnostic Imaging

Common symptoms and symptom complexes are addressed by this tool. Imaging requests for patients with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician may provide additional insight.

This version incorporates MSI accepted revisions prior to 11/30/08

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PEDIATRIC AND CONGENITAL MUSCULOSKELETAL IMAGING GUIDELINES

PACMS-1~GENERAL GUIDELINES

- The Musculoskeletal Imaging Guidelines are the same for both the pediatric population and the adult population, unless there are specific guidelines listed here in the Pediatric and Congenital Musculoskeletal Imaging Guidelines.
- Advanced imaging can be ordered in almost any musculoskeletal condition and does show abnormality in most musculoskeletal conditions, however, that does not mean that it is indicated in these situations.
- The guidelines are divided into two basic sections:
 - Disease/Injury Category and 2) Anatomical Area Category
 - Some conditions, e.g. tumors can occur in any area and some, e.g. torn meniscus are specific to certain anatomical areas.
- These guidelines are diagnosis oriented so it is imperative that the reviewer have a working/tentative diagnosis prior to review.
 - Prior to considering advanced imaging, patients should undergo a recent detailed history, physical examination, appropriate laboratory studies, and the use of non advanced imaging modalities such as plain x-ray.
 - Advanced imaging should serve as an adjunct in arriving at a more definitive diagnosis.
 - Orthopedic specialist evaluation can be helpful in determining the need for advanced imaging.
- These guidelines are based upon using advanced imaging to answer specific clinical questions that will affect patient management.
 - Imaging is not indicated if the results will not affect patient management decisions.
- Standard medical practice would dictate continuing conservative therapy prior to advanced imaging in patients who are improving on current treatment programs.

PACMS-2~IMAGING TECHNIQUES

- **Plain x-ray**
 - Should be done prior to advanced imaging in most musculoskeletal conditions* to rule out those situations that do not require advanced imaging, such as osteoarthritis, acute/healing fracture, osteomyelitis, and tumors of bone amenable to biopsy or radiation therapy (in known metastatic disease), etc.
 - *ACR Appropriateness Criteria, Musculoskeletal Imaging topics
 - Even in soft tissue masses, plain x-rays are helpful in evaluating for calcium/bony deposits, e.g. myositis ossificans and invasion of bone.
- **MRI versus CT**
 - In general MRI is the preferred imaging modality in musculoskeletal conditions because it is superior in imaging the soft tissues and can also define physiological processes in some instances, e.g. edema, loss of circulation (AVN), and increased vascularity (tumors).
 - CT is better at imaging bone and joint anatomy; thus it is useful for studying complex fractures (particularly of the joints) and dislocations.

- **Contrast Issues**

- Most musculoskeletal imaging (MRI or CT) is without contrast.
- **Exceptions:**
 - Tumors and osteomyelitis (without and with contrast)
 - MR arthrograms, CT myelogram, CT for discogram (with contrast only)
 - MRI for rheumatoid arthritis (generally with contrast only)
 - In postoperative joint studies, MRI with contrast (direct or indirect arthrogram) can be approved if requested.

PACMS-3~3-D RENDERING

- Certain health plans do not reimburse the 3-D rendering CPT codes (CPT 76376 and 76377) and their coverage policies will take precedence over MedSolutions' guidelines. Prior authorization does not guarantee payment of the study.
- **Musculoskeletal indications for 3-D imaging are as follows:**
 - Complex fractures of any joint or the pelvis
 - Spine fractures
 - Preoperative planning in complex surgical cases*
 - These requests should be sent for Medical Director review.

**ACR 2006 Coding Update Sept/Oct 2005*

<http://www.acr.org>. Accessed November 28, 2006

DISEASE/INJURY CATEGORY (ALPHABETICAL ORDER)

PACMS-4~AVASCULAR NECROSIS (AVN)–Legg-Perthe's Disease

- **Legg-Perthe's Disease Avascular Necrosis (AVN) of the hip in children**
 - Occurs when the femoral head loses its blood supply.
 - Affects children between the ages of 4 and 8 (occasionally younger and older).
 - Clinically is quite different than adult AVN since there is good healing potential of the femoral head (especially in younger children).
 - Plain x-ray is the initial imaging study and may be all that is necessary for follow-up.
 - If the diagnosis is uncertain on plain x-ray, hip MRI without contrast (either unilateral CPT 73721 or pelvis CPT 72195) can be approved.
 - Treatment is observation in mild cases and containment of the head within the acetabulum by abduction bracing in more severe cases.*

**Greene WB (Ed.). Essentials of Musculoskeletal Care. 2nd*

Ed.Rosemont,IL, American Academy of Orthopaedic Surgeons,2001, pp.675-677

PACMS-5~FRACTURE AND DISLOCATION

• PACMS-5.1 Acute

- Plain x-rays should be performed initially in any obvious or suspected acute fracture or dislocation.
- If plain x-rays are positive, no further imaging is generally indicated except in complex joint fractures where noncontrast CT is helpful.^{1,2}
- If plain x-rays are negative or equivocal for fracture, and fracture is still clinically suspected, a several week trial of conservative therapy with periodic clinical re-evaluation and repeat x-rays is indicated prior to considering advanced imaging.
 - CT or MRI without contrast can be performed sooner if the results will determine immediate treatment decisions as documented by the treating physician (e.g. fractures of the scaphoid, femoral neck and shaft, tibia, acetabulum).
- Orthopedic evaluation is helpful in determining the appropriate imaging pathway.

¹ACR Appropriateness Criteria, Acute hand and wrist trauma, 2008

²Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed.

Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.36

• PACMS-5.2 Joint

- CT can be approved in complex fractures involving a joint for preoperative planning.*

*Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed.

Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001, p.41

*ACR Appropriateness Criteria, Acute hand and wrist trauma, 2008

- Orthopedic evaluation is helpful in determining the need for advanced imaging.

• PACMS-5.3 Metaphysis (end of bone)/Diaphysis (shaft of bone)

- These fractures can generally be diagnosed and managed adequately with plain x-ray.
- If there is concern for delayed union or non-union of the bone, CT without contrast is appropriate.

• PACMS-5.4 Osteochondral/Chondral

- These fractures are joint fractures essentially of the joint surface (a piece of bone with attached cartilage, or a piece of cartilage alone).
- If x-rays are negative and an osteochondral fracture is suspected, MRI without contrast is the appropriate imaging study.
- CT without contrast can be approved if MRI is contraindicated.*

*ACR Appropriateness Criteria, Chronic Ankle Pain, 2005

• PACMS-5.5 Stress/Occult Fracture

- These fractures, almost always in weight bearing bones, can be evaluated adequately by history, physical exam, plain x-ray, and bone scan.
- Plain x-rays should be performed initially.
- A history of increased physical activity is often elicited and swelling and tenderness are present on exam.
- Plain x-rays are usually negative initially and become positive at 3 to 4 weeks. Bone scan will be positive within 72 hours of onset.
- Treatment includes protected weight bearing with or without casting.

- Occasionally surgery is necessary, particularly for 5th metatarsal fractures.
- Periodic follow-up plain x-rays will usually show progressive healing.
- Except in situations where there is concern for non-union, advanced imaging is not routinely performed.
- **Exceptions** are hip, femur, and tibial stress fractures--MRI without contrast or CT without contrast can be approved if stress fracture is suspected because prolonged healing with a poor outcome can occur with delayed diagnosis.*

*Greene WB (Ed.). *Essentials of Musculoskeletal Care. 2nd Ed.* Rosemont,IL, Academy of Orthopaedic Surgeons, 2001, p.356

- **References:**

- ACR Appropriateness Criteria, Stress/Insufficiency Fracture, 2008
- Green WB (Ed.). *Essentials of Musculoskeletal Care. 2nd Ed.* Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, p.508

- **PACMS-5.6 Compartment Syndrome**

- Caused by swelling in the closed compartments of the extremities
- Advanced imaging is not indicated
- Diagnosis is made clinically and by direct measurement of compartment pressure and is a surgical emergency*

*Greene WB (Ed.). *Essentials of Musculoskeletal Care. 2nd Ed.* Rosemont,IL, Academy of Orthopaedic Surgeons, 2001, pp 18-19

PACMS-6~FOREIGN BODY

- MRI (contrast as requested) can be approved after plain x-rays rule out the presence of radiopaque foreign bodies.*

*Am Fam Physician 2003 June;67(12):2557-2562

PACMS-7~MASS

- **PACMS-7.1 General Considerations**

- History and Physical exam--information should include location, size, duration, solid/cystic, fixed/not fixed to bone
- Plain x-rays should be performed initially (see PACMS-2 Imaging Techniques).
- Most discrete masses warrant imaging (usually MRI without and with contrast).
- **Exceptions-** advanced imaging is generally **not** indicated for the following entities:

- Ganglia
- Sebaceous cyst
- Subcutaneous lipoma does not require imaging for diagnosis
 - Evaluation by a dermatologist or surgeon is helpful in determining the need for advanced imaging.
 - If the clinical exam is equivocal, ultrasound should be performed initially.
 - Noncontrast MRI can be performed if surgery is planned.
- Lipomas in other locations (not subcutaneous) should be evaluated by ultrasound or CT without and with contrast.

- Lesions with Hounsfield units less than -50 HU do not require additional imaging except for surgical planning.*
 - *[Scott-Conner CEH and Radebold K. *Lipomas*. eMedicine, April 17, 2006. http://www.emedicine.com. Accessed September 11, 2007](http://www.emedicine.com)
 - Noncontrast MRI can be considered if ultrasound and/or CT are equivocal, or for preoperative planning.
 - Ill-defined mass/swelling: ultrasound should be performed as the initial study
 - Mass that has been present and stable for 1 year
 - Most hematomas can be adequately imaged by ultrasound.*
 - *[Krolo I, Babiae N, Marotti M, et.al. *Ultrasound in the Evaluation of Sports Muscular Injury*. Jan 7, 2000 http://www.actaclinica.kbsm.hr/arhiva/Acta2000/acta. Accessed October 16, 2007](http://www.actaclinica.kbsm.hr/arhiva/Acta2000/acta)
 - Orthopedic or Surgical evaluation is helpful in determining the need for advanced imaging.
- **PACMS-7.2 Soft tissue mass with negative x-ray**
 - MRI (contrast as requested) can be performed (ultrasound or CT with contrast if MRI is contraindicated)*
 - *[ACR Appropriateness Criteria, Soft tissue masses, 2005](#)
- **PACMS-7.3 Soft tissue mass with calcification on x-ray**
 - CT without contrast if Myositis Ossificans (bone formation in muscle tissue after trauma) is suspected.*
 - *[ACR Appropriateness Criteria, Soft tissue masses, 2005](#)
 - MRI without and with contrast if not demonstrated to be Myositis Ossificans by CT*
 - *[ACR Appropriateness Criteria, Soft tissue masses, 2005](#)
- **PACMS-7.4 Bone or Attached to Bone (including lytic and blastic metastatic disease)**
 - MRI (contrast as requested) can be performed (CT without and with contrast if MRI is contraindicated)*
 - *[ACR Appropriateness Criteria, Bone tumors, 2005](#)

PACMS-8~MUSCLE/TENDON UNIT INJURIES/DISEASES

- Almost all complete tendon ruptures can be diagnosed by physical exam showing loss of function of the affected joint and/or palpable disruption of the involved tendon.
- If history and physical exam point to a suspected partial tendon rupture of a specific tendon named in the clinical information, then MRI without contrast is appropriate.¹
- Muscle belly strains/muscle tears can be diagnosed clinically by history and physical exam. Although MRI is positive, it is not needed for diagnosis.²
- For acute strains, treatment initially consists of rest, application of ice, compression and avoidance of painful activity. Surgical treatment is generally not recommended, even for complete tears. Muscle tissue is not amenable to surgical repair.*
 - *[Am Fam Physician 1999 Oct;60\(6\):1687-1696](#)

- Inflammatory myopathies (polymyositis, dermatomyositis, inclusion body myositis, myositis of malignancy)
 - Also see PACPN-4 Inflammatory Muscle Diseases in the Pediatric and Congenital Peripheral Nerve Disorders guidelines.
 - ¹ACR Appropriateness Criteria, Chronic ankle pain, 2005
 - ²Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, p.330

ANATOMICAL AREAS

PACMS-9~OSGOOD-SCHLATTER'S DISEASE

- Traction apophysitis of the tibial tubercle in skeletally immature individuals
- Diagnosis is by clinical examination and x-ray^{1,2}
- Treatment is conservative^{1,2}
- Advanced imaging is not generally indicated in this disorder.
 - ¹Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.684-685
 - ²Osgood-Schlatter Disease. Medline Plus, <http://www.nlm.nih.gov/medlineplus> Accessed September 28, 2007

PACMS-10~KNEE--BAKER'S CYST

- Baker's cyst in children is a different clinical situation than in adults and is almost never due to intra-articular pathology.
 - Usually treated conservatively and rarely requires surgery.
 - Ultrasound is the appropriate imaging study.*
- *Baker's Cyst/Popliteal Cysts. *Wheeless' Textbook of Orthopaedics* Presented by Duke Orthopaedics, Duke University Medical Center <http://wheelessonline.com>. Accessed November 27, 2006

PACMS-11~SLIPPED CAPITAL FEMORAL EPIPHYSIS (SCFE)

- Slipped capital femoral epiphysis (SCFE) should be considered in adolescents or preadolescents with groin, anterior thigh, or atraumatic knee pain.
 - Symptoms often include a history of intermittent limp and pain for several weeks or months that are often poorly localized to the thigh, groin, or knee.
 - Any obese adolescent or preadolescent presenting with a history of a limp and thigh, knee, or groin pain for several weeks to one month should be presumed to have a slipped capital femoral epiphysis (SCFE) until proven otherwise.*
 - Although SCFE is usually associated with obesity (defined as above 95th percentile of weight for age), it can also occur in children who are not obese.
- Physical examination:

- Hip examination shows painful motion, loss of internal rotation, and there is often a discernable external rotation deformity of the extremity.
- Knee examination is always normal (no swelling, instability, joint line tenderness, erythema, or warmth)
- The distal neurovascular examination is always normal
- Imaging studies:
 - Anteroposterior and lateral x-rays (frog leg or cross table lateral) of both hips will confirm or exclude the diagnosis
 - Advanced imaging is not generally indicated
- Treatment:
 - Once the diagnosis is made, the child is made non-weight bearing and placed on crutches or in a wheelchair and should be referred to an Orthopedic surgeon.*
 - Treatment is surgical and should be performed as soon as possible.
- Reference:
 - *Am Fam Physician* 1998 May 1;57(9):2135

PACMS-12~LEG LENGTH DISCREPANCY

- Prediction of ultimate limb length discrepancy is an inexact science.
 - A small limb length discrepancy (e.g. 1.5 cm) has no known deleterious effects.
 - The goal in epiphysiodesis, when done, should be near and not necessarily perfect limb length equality.*
 - **International Pediatrics* 2004;19(3):132-133
 - Radiographic scanogram remains the gold standard for leg length measurement.* Such measurement procedures are reported with CPT 77073, regardless of the modality used, including “CT scanograms.”
 - **Journal of Pediatric Orthopaedics* 2005 Nov/Dec;25(6):747-749
- Advanced imaging is generally not indicated.

PACMS-13~FOOT-CONGENITAL ANOMALIES

- **Tarsal Coalition** (Calcaneonavicular Bar/Rigid Flat Foot)
 - Plain x-rays should be performed initially since the calcaneonavicular bar is readily visible in older children and adults.
 - Talocalcaneal coalition is more difficult to evaluate on plain x-rays.
 - If tarsal coalition is suspected (because of restricted hindfoot motion on physical exam), and plain x-rays are negative, CT or MRI without contrast (CPT 73700 or 73718) can be approved.*
 - **ACR Appropriateness Criteria, Chronic foot pain, 2005*
- **Club Foot**
 - **Definition:** Congenital foot contracture with foot in equinus (plantar flexion) and heel and forefoot in varus/adduction (turned in).
 - Immediate diagnosis and specialty evaluation in the first week of life provide the best chance for successful correction.
 - Treatment consists of serial casting; surgery is reserved for the difficult cases.*

- MRI or CT without contrast (CPT 73700 or 73718) can be approved if requested by the treating specialist, usually as a preoperative evaluation.

*Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.613-615

PEDIATRIC AND CONGENITAL MUSCULOSKELETAL IMAGING GUIDELINE REFERENCES

PACMS-2~Imaging Techniques

- *ACR Appropriateness Criteria, Musculoskeletal Imaging topics.*

PACMS-3~3-D Rendering

- *ACR 2006 Coding Update. Sept/Oct 2005, <http://www.acr.org>. Accessed November 28, 2006.*

PACMS-4~Avascular Necrosis (AVN)—Legg-Perthe's Disease

- *Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.675-677.*

PACMS-5~Fracture and Dislocation

- *ACR Appropriateness Criteria, Acute hand and wrist trauma, 2008.*
- *Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.18,19, 36, 41, 356, 508.*
- *ACR Appropriateness Criteria, Chronic ankle pain, 2005.*
- *ACR Appropriateness Criteria, Stress/Insufficiency Fracture, 2008.*

PACMS-6~Foreign Body

- *Chan C and Salam GA. Splinter removal. *Am Fam Physician* 2003 June;67(12):2557- 2562.*

PACMS-7~Mass

- *Scott-Conner CEH and Radebold K. *Lipomas*. *Medicine*, April 17, 2006, <http://www.emedicine.com>. Accessed September 11, 2007.*
- *Krolo I, Babiae N, Marotti M, et. al. *Ultrasound in the Evaluation of Sports Muscular Injury*. Jan 7, 2000, <http://www.acta-clinica.kbsm.hr>. Accessed October 16, 2007.*
- *ACR Appropriateness Criteria, Soft tissue masses, 2005.*
- *ACR Appropriateness Criteria, Bone tumors, 2005.*

PACMS-8~Muscle/Tendon Unit Injuries/Diseases

- *O'Kane JW. *Anterior Hip Pain*. *Am Fam Physician*1999 Oct;60(6):1687-1696.*
- *ACR Appropriateness Criteria, Chronic ankle pain, 2005.*
- *Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001,p.330.*

PACMS-9~Osgood-Schlatter's Disease

- *Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.684-685.*
- *Osgood-Schlatter Disease. Medline Plus, <http://www.nlm.nih.gov/medlineplus> Accessed September 28, 2007.*

PACMS-10~Knee—Baker's Cyst

- *Baker's Cyst/Popliteal Cysts. *Wheeless' Textbook of Orthopaedics* Presented by Duke Orthopaedics, Duke University Medical Center <http://wheelessonline.com>. Accessed November 27, 2006.*

PACMS-11~Slipped Capital Femoral Epiphysis

- *Loder RT. Slipped capital femoral epiphysis. *Am Fam Physician* 1998 May 1;57(9):2135.*

PACMS-12~Leg Length Discrepancy

- *Stanitski D. Practical assessment and treatment of leg length discrepancy in children (Editorial). *International Pediatrics* 2004;19(3):132-133.<http://www.int-pediatrics.org>. Accessed September 30, 2007.*

- Leitzes A, Potter HG, Amaral T, et. al. Reliability and accuracy of MRI scanogram in the evaluation of limb length discrepancy.
- *Journal of Pediatric Orthopaedics* 2005 Nov/Dec;25(6):747-749.
<http://www.pedorthopaedics.com>. Accessed September 30, 2007.

PACMS-13~Foot—Congenital Anomalies

- *ACR Appropriateness Criteria, Chronic foot pain*, 2005.
- Greene WB (Ed.). *Essentials of Musculoskeletal Care*. 2nd Ed. Rosemont,IL, American Academy of Orthopaedic Surgeons, 2001, pp.613-615.