Evidence Based And Systems Based Best Practices For Management Of Imaging Utilization

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Harvard Medical School
Evidence and Systems Based Approaches

• Evidence based appropriateness criteria
• Implementation of appropriateness criteria based decision support systems—point-of-care CPOE systems
• Systems to identify duplicate exams
• Systems for improved provider feedback and education
• Appropriateness criteria for radiologists’ recommendations
ACR Appropriateness Criteria®

The ACR Appropriateness Criteria® are evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decisions for a specific clinical condition. By employing these guidelines, providers enhance quality of care and contribute to the most efficacious use of radiology.

The guidelines are developed by expert panels in diagnostic imaging, interventional radiology, and radiation oncology. Each panel includes leaders in radiology and other specialties. There are currently 157 topics with over 800 variants in the September 2009 Version.

The ACR allows individuals to use the ACR Appropriateness Criteria® for research, scientific, and/or informational purposes only. If you wish to use the ACR Appropriateness Criteria® for other reasons, please contact the ACR at cr_acr@acr.org or 703-646-6900 for permission and licensing information.

ACR Appropriateness Criteria® Search Engine

This search engine allows you to search for clinical conditions found within the ACR Appropriateness Criteria® documents.

Click here to use our ACR Appropriateness Criteria® Search Engine

Anytime, Anywhere™ Application for Handheld Electronic Devices (Coming Soon)

In collaboration with SkyScape, the ACR has developed the Anytime, Anywhere™ application for handheld electronic devices as an alternative solution to radiology benefit management companies or computerized physician order entry systems that do not contain the ACR Appropriateness Criteria® guidance. This application provides instant, point-of-care access to all of the 157 topics, which can be directly downloaded onto the
ACR Appropriateness Criteria

• Under development since the early 1990s
• Evidence and consensus based
• Teams with participation of non radiologist experts in each categorical area
• Over 160 topics with 800 variants
ACR Appropriateness Criteria

- Cover diagnostic, interventional and therapeutic applications
- Cited widely as the basis for CPOE and Radiology Benefits Management programs
- Continuous gathering and updating of evidence
- Not in a readily usable format
# Appropriate Imaging Study Modules

**Susanna I. Lee MD, PhD** and **James H. Thrall, MD**  
Massachusetts General Hospital, Harvard Medical School

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<th>Module</th>
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<th>Quiz Mode</th>
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</table>
A 62 yo man reports wrist pain after trauma. Exam reveals scaphoid tenderness.

- NUC Tc-99m bone scan wrist
- CT wrist without contrast
- X-ray wrist
- MRI wrist without contrast
- No imaging
Acute Hand and Wrist Trauma

Suspect acute scaphoid fracture, first exam.

**Question:** A 62 yo man reports wrist pain after trauma. Exam reveals scaphoid tenderness.

**Answer:** X-ray wrist is most appropriate here. (9)

CT wrist without contrast is not appropriate. (1)

MRI wrist without contrast is not appropriate. (1)

NUC Tc-99m bone scan wrist is not appropriate. (1)

**Image description:** Scaphoid fracture. Wrist X-ray posteroanterior (A) and semipronated (B) views show scaphoid irregularity (arrow) corresponding to a fracture.

ACR Appropriateness Criteria®
### MGH Computerized Physician Order Entry and Decision Support System

#### Patient Information

- **Patient Name:** THRALL MD, JAMES
- **MRN:** 2963882
- **Ordering Physician:** Thrall, James H

#### Pending Exams

<table>
<thead>
<tr>
<th>Action</th>
<th>Exam</th>
<th>Physician</th>
<th>Schedule</th>
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<tbody>
<tr>
<td></td>
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<td>Thrall, James H</td>
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#### Exams Available

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<tr>
<th>Modality</th>
<th>Procedure</th>
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<tr>
<td>MR</td>
<td>Breast MRI</td>
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<tr>
<td></td>
<td>Chest MRI</td>
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<tr>
<td></td>
<td>Extremity MRI</td>
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<td>Face Or Sinus MRI</td>
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<td>Head (stream) MRI</td>
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<td>Kidney/Adrenal (Glu) MRI</td>
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<td>Liver/Pancreas/Spleen MRI</td>
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<td>MRI Arthrogram</td>
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<td>Neck MRI</td>
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<td>Pelvis (Bone) MRI</td>
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<td>Pelvis Soft Tissue MRI</td>
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<td></td>
<td>Spine MRI</td>
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#### Contact Information

- **ABDOMINAL:** 617-726-8566
- **BREAST IMAGING:** 617-726-3033
- **CHEST:** 617-726-4354
- **MUSCULOSKELETAL:** 617-726-7717
- **NEURORADIOLOGY:** 617-726-8920
- **NUCLEAR:** 617-726-6350
- **PEDIATRICS:** 617-726-4307
Spine MRI

Patients must be cooperative and able to hold still for 1 hour to have an MRI Scan.

If sedation is required call 4.XRAY.

Note: There are important new concerns from the FDA about the use of gadolinium in patients with kidney failure. Please see the latest PCOI Practice Alert for more information.

Information about MRI Safety
Information about Imaging obese Patients

SPECIAL CONSIDERATIONS, Check if Appropriate Contrast

Contrast MUST NOT BE USED because:

Patient Info/Hx
☐ Artificial heart valve or implanted Device
☐ Claustrophobia
☐ Ear implant or prosthesis
☐ Employment as metal worker
☐ Interstitial aneurysm clip
☐ Metallic foreign body
☐ Pacemaker, AICD or Pacing Wires
☐ Pregnant

Films/Reports

Send additional reports to:

EXAM REQUESTED Pick only ONE of the Following

☐ Cervical: Musculoskeletal Interpretation
☐ Cervical: Neuroradiology Interpretation
☐ Thoracic: Musculoskeletal Interpretation
☐ Thoracic: Neuroradiology Interpretation
☐ L-S: Musculoskeletal Interpretation
☐ L-S: Neuroradiology Interpretation
☐ Limited complete (for vertebrae)
☐ Sacrum
☐ SI Joints

At least one box MUST be selected from either of the following groups

SIGNS / SYMPTOMS

☐ Abnormal extremity reflexes
☐ Abnormal extremity sensation
☐ Back pain
☐ Back pain following trauma
☐ Back pain, prior surgery
☐ Extremity weakness (paraplegia)
☐ Mass or lump
☐ Neck pain
☐ Neck pain following trauma
☐ Radiculopathy
☐ Sciatic leg pain

Just-in-time information—education-- for referring physicians
When is Imaging Helpful for Patients with Back Pain?

Imaging Modalities for the Spine
Scheduling
Further Information
References

Since the lifetime prevalence of low back pain is about eighty percent, it is hardly surprising that back pain is one of the most common reasons for patients to seek medical care. However, in the vast majority of cases, acute back pain (duration less than three months) is a self-limited condition that resolves with analgesic treatment and activity modification. In more than 80% of cases of back pain (Table 1), imaging will not affect treatment. However, it may lead to unnecessary additional testing due to the discovery of incidental benign lesions and nonspecific degenerative processes that may also occur in asymptomatic individuals.

In a recent study of patients with low back pain who had been referred for radiographic evaluation, only 3.7% went on to have surgery. However, the rate of

Figures A and B: In a 72 year old patient with intermittent low back pain, MR images of the lumbar spine show multi-level abnormalities, such as severe spinal stenosis at L3-4 and disk herniation at L5-S1, that are far more impressive than the degree of symptoms.
MRI Safety

- MRI is generally very safe and adverse reactions to contrast agents are extremely rare.
- Recent reports suggest an association between gadolinium contrast administration and nephrogenic systemic fibrosis in patient with moderate to severe renal insufficiency.
- Cardiac pacemakers, implanted cardiac defibrillators, otic/inner ear/cochlear implants, and metal fragments in the eye contraindicate MRI.
- Loose ferromagnetic objects can become dangerous missiles in an MRI room.
- In order to ensure patient safety, all implants that contain metal must be verified as safe before an MRI procedure can be performed.

Surgical Implants and Prostheses
Pregnancy and Breast Feeding
Sedation and Anesthesia
The Patient Experience
Scheduling
Further Information
“Pick-lists” for exam and reason for doing it
Duplicate Exam Warning

Search engine finds all prior or scheduled exams of the same type.
“Appropriateness” Values

1-3
Low Utility

4-6
Intermediate

7-9
High Utility
Physician can proceed, cancel or modify order

Spine MRI

Patients must be cooperative and able to hold still for 1 hour to have an MRI Scan. If sedation is required call 4 XRAY.

Note: There are important new concerns from the FDA about the use of gadolinium in patients with kidney failure. Please see the latest PCOI Practice Alert for more information.

Information about MRI Safety
Information about Imaging obese Patients

SPECIAL CONSIDERATIONS, Check if Appropriate

Contrast
Contrast MUST NOT BE USED because:

Patient Info/Hx
☐ Artificial heart valve or Implanted Device  ☐ Claustrophobia
☐ Ear implant or prosthesis  ☐ Employment as metal worker
☐ Intracranial aneurysm clip  ☐ Metallic foreign body
☐ Pacemaker, AICD or Pacing Wires  ☐ Pregnant

Films/Reports
☐ Tumor volume

Send additional reports to:
Spine MR is indicated for the clinical indications provided.

Indicated 7-9  Marginal 4-6  Low Utility 1-3

Alternate procedures to consider:

X_Ray  CT

5  5
MRI Appropriateness Ordering Trends Post Implementation of CPOE with Decision Support

Modified ACR AC

11% Low Appropriateness

2% Low Appropriateness
CT Brain Appropriateness Ordering Trends Post Implementation of CPOE with Decision Support

12% Low Appropriateness

4% Low Appropriateness
Effect of Computerized Order Entry with Integrated Decision Support on the Growth of Outpatient Procedure Volumes: Seven-year Time Series Analysis

**Purpose:**
To determine the effect of a computerized radiology order entry (ROE) and decision support (DS) system on growth rate of outpatient computed tomography (CT), magnetic resonance (MR) imaging, and ultrasonography (US) procedure volumes over time at a large metropolitan academic medical center.

**Materials and Methods:**
Institutional review board approval was obtained for this study of de-identified aggregate administrative data. The research was compliant with HIPAA; informed consent was waived. This was a retrospective study of outpatient advanced imaging utilization before, during, and after implementation of a Web-based ROE and DS system. Dependent variables were the quarterly volumes of outpatient CT, MR imaging, and US examinations from quarter 4 of 2000 through quarter 4 of 2007. Outpatient visits during each quarter were included as control variables. These data were analyzed as three separate time series with piecewise linear regression for simultaneous estimation of quarterly examination volume trends before and after ROE and DS system implementation. This procedure was repeated with log transformed quarterly volumes to estimate percentage growth rates.
ROE DS Impact On Outpatient CT Utilization

Annual Compound Growth Rate
12%

CT Scan Utilization

ROE Penetration

Annual Compound Growth Rate
1%

Decision Support Rules In Effect

Composite is a utilization rate weighted mean of BCBS, HPHC, & TAHP weighted by the average distribution of total P4P withhold over time.

BCBS rates are weighted tests per 1000 members; HPHC & TAHP rates are unweighted tests per 1000 members.

Year 2008 Actual Utilization is based on claims data with service dates Jan08 through Aug08, paid as of Sep 08.

MGPO actual imaging tests per 1000 members (MRIs, CT Scans, Nuclear Cardiology)

Impact of Decision Support

Begin Q2-3 2003

Full implementation Q2 2005
Utilization Report for Providers in an MGH Primary Care Practice

Adjusted CT/MR/Nuc scans per 100 patients in panel in 2007

5X variation between providers in the same practice
“IBIS” Pilot 2 (CY09 Q2 – CY09 Q4)
Study of the Impact Concurrent Display of Imaging Utilization and Quality Data has on PCP Utilization & Scoring

Concurrent feedback of individual performance
Recommendation rates for exams performed for identical clinical indications read by different radiologists

I_{REC} rates for different radiologists

Radiologists
Variation Reporting: Radiologist Recommendations
Analysis of 6M Diagnostic Exams

Observed to expected ratios by radiologist, by subspecialty area
ACR CT and DR Dose Registries

- The ACR is implementing CT and DR dose registries— in pilot phase
- Currently no convenient way to record exposure data
- ACR is working with vendors to develop automated solutions especially for CT
- The registries will provide immediate feedback for anomalies
- Benchmarking and establishment of best practices for adult and pediatric applications
Welcome to the National Radiology Data Registry

Enter NRDR

CTC
CT ColonoGRAPHY REGISTRY
> CLICK HERE TO ENTER

GRID
GENERAL RADIOLOGY IMPROVEMENT DATABASE
> CLICK HERE TO ENTER

ICE
IV CONTRAST EXTRAVASATION
> CLICK HERE TO ENTER

NOPR
NATIONAL ONCOLOGIC PET REGISTRY
> CLICK HERE TO ENTER

NMD
NATIONAL MAMMOGRAPHY DATABASE
> CLICK HERE TO ENTER

DIR
DOSE INDEX REGISTRY
> COMING SOON
2010
Chest

CTDvol vs Age

Female
Male
Protocol Optimization

• Protocols may not be revised for new technology
• Some radiology groups have not spent the time necessary to optimize protocols
  – Patient size
  – Patient age
  – Clinical indication
  – # of prior exams
• Ambiguous chain of command in many hospitals hinders adoption of best practices
  – Two different governance structures
    • Hospital personnel
    • Physicians
  – Technologists often do not report to radiologists

One size does not fit all patients
Color coded guide based on indication categories for helping radiologists and technologists select CT protocols for children

- Pink - Routine, R/O
- Green - Low dose, F/U
- Red - Ultra low dose, bone and multiple exams
- Yellow - Stone protocol
- Blue - High dose, high res
- Grey - CT angiography

Developed at MGH by Manudeep Kalra MD and colleagues
“Image Wisely”, a new campaign underway from the RSNA and ACR will follow the principles of Image Gently.
The imaging community has the opportunity through Image Gently, Step Lightly and Image Wisely and the ACR Quality and Safety Registries to parallel the FDA’s efforts in the concept of safe use.
Observations

- Imaging has transformed medical practice and appropriate imaging should be encouraged.
- Development of better evidence and better methods to educate referring physicians is key to improving utilization.
- Decision support at the point-of-care appears to work effectively and should be explored more widely.
- New technology and new protocol approaches offer substantial promise to reduce doses.
- There is no low tech alternative in the US health system and we must do better in the stewardship of high technology medicine.