THE AMERICAN COLLEGE OF RADIOLOGY

ACR APPROPRIATENESS CRITERIA™ PROJECT

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INTRODUCTION

In April of 1993, one of the leading items on newly elected President Clinton's agenda was health care reform. At the same time, the American College of Radiology (ACR) was receiving frequent inquiries from radiologists, hospitals and payers about the availability of appropriateness criteria for radiologic procedures as competition in managed care began to accelerate. In that context, then chairman of ACR Board of Chancellors, K. K.Wallace, Jr., MD, had the opportunity to speak before the House Ways and Means Health Subcommittee concerning the 1994 Medicare budget. At that time Dr. Wallace indicated that the ACR would be taking a leadership role in defining the most cost-effective and beneficial ways of utilizing radiologic services, by the development of clinical practice guidelines. He explained that this endeavor could lead to significant savings for our health care system without a negative impact on quality of care. This testimony served as the initiating event leading to the creation of the ACR Appropriateness Criteria Task Force for Radiologic Procedures (Table 1). By August, the structure and consensus methodology had been formulated for the task force (Tables 2). Following appointment of panel chairs in late 1993, the first panelists were selected during early 1994 and by Spring deliberations had begun.

TASK FORCE STRUCTURE AND PROCESS

The Task Force is comprised of 10 consensus panels, eight diagnostic and two therapeutic (Table 3). The diagnostic panels are divided along organ system lines, with added panels addressing the specific needs of pediatric and women's imaging. There are separate treatment decision panels for radiation oncology and interventional radiology. All panels are chaired by individuals with leadership capabilities and acknowledged expertise in the area of focus. Panel participants are selected in such a way as to provide wide representation. Radiologists and physicians from other specialty societies appropriate to the subject material work together on the panels. Physicians other than radiologists are nominated by their specialty society as representatives. There is broad geographical representation including physicians from academic and private practice settings. Panel chairs are careful to make sure that there are experts in all imaging modalities serving on each of the diagnostic panels. As of September 1999, there were 210 individuals serving on panels, including 35 representatives from 19 specialty societies outside of radiology (Tables 4-5). Over 140 clinical conditions with 820 variants have been published (1,2) with 49 additional conditions under study. Panel activities begin with the selection and prioritization of clinical conditions to be addressed based on disease prevalence, the degree of variability in practice, the relative economic impact and the potential for morbidity/mortality and subsequent improved care. Each question is reviewed and refined to be as clear as possible and frequently conditions are broken down into a number of pertinent variations. Panelists are appointed as "topic leaders" with the responsibility for guiding each specific clinical condition to a conclusion. There can be up to a dozen topics under deliberation within each panel at any given time. The topic leaders review the scientific literature, analyze the data and then develop an evidence table. The table is a brief summation of the findings of the most important scientific articles published on the subject at hand. These tables are an aid to the panelists

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The complete work of the ACR Appropriateness Criteria™ Expert Panels is available from the American College of Radiology (1891 Preston White Drive, Reston, VA 20191-4397) in book format and is also available by accessing the ACR webpage at http://www.acr.org.

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An ACR Task Force on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician in light of all the circumstances presented in an individual examination. ACR Appropriateness Criteria™ are not designed as a guide for third-party reimbursement.

Table 1. ACR Appropriateness Criteria™ Task Force

Philip N. Cascade, MD, Chair, University of Michigan, Ann Arbor, MI

1. **Expert Panel on Cardiovascular Imaging**
   Michael A. Bettmann, MD, Chair
   Dartmouth Hitchcock Medical Center
   Lebanon, NH
2. **Expert Panel on Gastrointestinal Imaging**
   Philip W. Ralls, MD, Chair
   LAC & USC Medical Center
   Los Angeles, CA
3. **Expert Panel on Interventional Radiology**
   Jonathan M. Levy, MD, Chair
   Scottsdale Memorial Hospital
   Scottsdale, AZ
4. **Expert Panel on Musculoskeletal Imaging**
   Murray K. Dalinka, MD, Chair
   University of Pennsylvania Hospital
   Philadelphia, PA
5. **Expert Panel on Neurological Imaging**
   Burton P. Drayer, MD, Chair
   Mt. Sinai Medical Center
   New York, NY
6. **Expert Panel on Pediatric Imaging**
   David C. Kushner, MD, Chair
   Children's National Medical Center
   Washington, DC
7. **Expert Panel on Radiation Oncology**
   Steven Leibel, MD, Chair
   Memorial Sloan-Kettering Cancer Center
   New York, NY

   Bone Metastasis Work Group
   Robert Kagan, MD, Co-Chair
   Kaiser Permanente Medical Center
   Los Angeles, CA
   Christopher Rose, MD, Co-Chair
   St. Joseph Medical Center
   Burbank, CA

   Brain Metastasis Work Group
   David Larson, MD, PhD, Chair
   University of California, San Francisco
   San Francisco, CA

   Breast Work Group
   Brenda Shank, MD, PhD, Chair
   Doctor's Medical Center
   San Pablo, CA

   Hodgkin's Disease Work Group
   Peter Mauch, MD, Chair
   Joint Center for Radiation Therapy
   Boston, MA

   Lung Work Group
   William Sause, MD, Chair
   LDS Hospital
   Salt Lake City, UT

   Prostate Work Group
   Carlos Perez, MD, Chair
   Mallinckrodt Institute of Radiology
   St. Louis, MO

   Rectal/Anal Work Group
   Bruce Minsky, MD, Chair
   Memorial Sloan-Kettering Cancer Center
   New York, NY
8. **Expert Panel on Thoracic Imaging**
   Jack L. Westcott, MD, Chair
   Hospital of St. Raphael
   New Haven, CT
9. **Expert Panel on Urologic Imaging**
   E. Stephen Amis, Jr., MD, Chair
   Albert Einstein College of Medicine
   Montefiore Medical Center
   Bronx, NY
10. **Expert Panel on Women's Imaging**
    Ellen Mendelson, MD, Chair
    Western Pennsylvania Hospital
    Pittsburgh, PA

during the consensus process and serve as the basis for the written narrative for each clinical condition.

In most instances there are insufficient data available for meta-analysis and determination of a conclusion based on the science alone. Therefore, a broad-based consensus technique is needed to compliment the scientific data. The task force uses a modified Delphi methodology based on principles developed by the Institute of Medicine for the Agency for Health Care Policy and Research (AHCPR) (3-5) (Table 6). Serial surveys are conducted by distributing a written questionnaire, the evidence table and a draft of the topic narrative. Voting consists of assigning a score of 9-1 indicative of the most to least appropriate test or procedure. The participants work alone responding without influence from other panelists. At the end of each round of voting, an anonymous tabulation of the scoring distribution among the panelists is sent out along with the next questionnaire. A maximum of three rounds of questioning is carried out and consensus is considered present when 80% of the panelists are in agreement. If there is no agreement by the Delphi process, the panelists meet as a group to try to reach consensus whenever possible.

Since the practice of medicine is dynamic and undergoes constant change, the appropriateness criteria are to be reviewed every three years at a minimum. If major new scientific evidence comes to light in the interim, a panel can review a clinical condition at any time.

The ACR Appropriateness Criteria™ is currently undergoing the three-year review process described above. At the conclusion of this process, the entire product will be republished in several formats. A hard copy version of the ACR Appropriateness Criteria™ will be distributed with the June 2000 issue of *Radiology.*

Table 2. American College Of Radiology ACR Task Force on Appropriateness Criteria™ Development Process

1. Expert Panel Composition

- Finite number (required for Delphi process)
- Representation from all appropriate imaging modalities, academic and community practice radiologists, and broad geographic distribution
- Approval required by Board of Chancellors
- Invitations sent to other specialty societies for representation as appropriate

2. Topic Leader is the Author

- Responsibilities: assign duties related to topic development and to be the spokesperson for the topic.
- In a situation with co-authors, the Panel Chair appoints the senior author responsible for communication with the staff
- Staff develops topic folder and guides development process with input from the Chair. All information must be on file

3. Structure of Appropriateness Criteria Topic

- Initial draft narrative 3-5 pages
- Reference list comprised of current peer reviewed medical specialty journals, preferably most recent 5 years
- Key of definitions for types of research studies for use in Evidence Table
- Worksheet Appropriateness Questionnaire (WAQ) to query Expert Panel opinion

4. Consensus Building Process

- First Package to panel members is DELPHI ROUND 1 and contains:
  - Draft Narrative with reference list
  - Evidence Table with Key definitions (Panel members may request specific articles from the Evidence Table if needed)
  - WAQ(s)- Clinical Condition with variant(s) described
- Second package to panel members is DELPHI ROUND 2 and contains:
  - Tabulation to show the voting for Round 1 and the WAQ for Round 2 which is the second opportunity for the panel to vote to establish consensus (80%)
- Third package to panel members is DELPHI ROUND 3
  - Tabulation for Round 2 and Round 3 WAQ (if consensus has not been obtained in all options)
- Final package to panel members DELPHI FINAL RESULTS

Note: Brief comments which impact decision making process should appear in WAQ comment column. More extensive remarks must be documented, sent to staff who will contact Panel Chair and author if necessary. The Delphi process will not be disrupted once it begins. Consensus level identified through the Delphi process will remain unless panel agrees in its final discussion that there are extenuating circumstances which must be addressed.

5. Final Panel Conference Call or Meeting - to discuss unresolved issues

- Changes to narratives must reflect panel discussion. Areas of non-consensus are discussed according to specific rules. Authors submit marked up documents to ACR so that final changes can be incorporated for review process

6. Final Review Process - written comment period

- Expert Panel (follows Final Panel Conference Call/Meeting)
- Task Force Steering Committee

The success of this process has been dependent on direct communication, strict adherence to process, and prompt return of worksheet appropriateness questionnaires during Delphi Rounds.

USE OF APPROPRIATENESS CRITERIA

The ACR Appropriateness Criteria™, like other clinical guidelines, are intended to assist radiologists, referring clinicians, and patients in making initial decisions about radiologic tests and therapeutic procedures. The criteria apply to the majority of patients, but not all. These are aids to decision making, but the ultimate choices are those that are made by the radiologist and the referring physician with the approval of the patient. The criteria are not intended as guides for third-party payment.

It is likely that the ACR Appropriateness Criteria™ will be used to a varying degree depending on local needs and practices. In regions where managed care is prevalent, radiologists may be asked to conduct utilization management programs for radiology services. Whether the method is retrospective physician profiling or prospective screening, the ACR criteria can be a starting point for discussion of what is appropriate, although in many instances the criteria will be reviewed and modified by the involved physicians according to local conditions. The ACR Appropriateness Criteria™ will probably have less of an impact in areas with a lower degree of competition and managed care penetration. However, the Task Force has

Table 3. American College of Radiology Appropriateness Criteria™ Task Force Consensus Panels

Cardiovascular
Gastrointestinal
Musculoskeletal
Pediatric
Thoracic
Urologic
Neuroradiologic
Women's
Interventional
Radiation Oncology

received many communications indicating that the criteria are being used in instructional programs for referring practitioners, house staff officers and/or medical students in all kinds of settings. Perhaps the most frequent reference to the criteria will be in difficult clinical situations where radiologists are unsure of, or need support for, their selection of diagnostic or therapeutic studies.

It is unclear at this point in time what impact this program will have. We do not have the data to show whether the criteria have, or will have, reduced unnecessary radiology services. We also don't have the data to tell us whether the criteria are used in any way on a regular basis. Surveys don't necessarily

Table 4. ACR Appropriateness Criteria™ Expert Panel Member Listing.

Expert Panel on Cardiovascular Imaging. Michael Bettmann, MD, Chair, Dartmouth Hitchcock Medical Center, Lebanon, NH; Lawrence Boxt, MD, Beth Israel Medical Center, New York, NY; Antoinette S. Gomes, MD, UCLA School of Medicine, Los Angeles, CA; Julius Grollman, MD, Little Company of Mary Hospital, Torrance, CA; Robert E. Henkin, MD, Loyola University Medical Center, Maywood, IL; Charles B. Higgins, MD, UCSF, Medical Center, San Francisco, CA; Michael J. Kelley, MD, Charlotte Radiology, Charlotte, NC; Alan Matsumoto, MD, UVA Health System, Charlottesville, VA; Laurence Needleman, MD, Thomas Jefferson University Hospital, Philadelphia, PA; Heriberto Pagan-Marin, MD, Boston University Medical Center, Boston, MA; Joseph Polak, MD, MPH, Brigham and Women's Hospital, Boston, MA; William Stanford, MD, University of Iowa Hospital & Clinics, Iowa City, IA; William Abbott, MD, Massachusetts General Hospital, Boston, MA, Society of Vascular Surgery; Steven Port, MD, University of Wisconsin, Milwaukee, WI, American College of Cardiology.

Expert Panel on Gastroinestinal Imaging. Philip W. Ralls, MD, Chair, LAC & USC Medical Center, Los Angeles, CA; Dennis M. Balfe, MD, Mallinckrodt Institute, St. Louis, MO; Robert L. Bree, MD, University of Michigan Medical Center, Ann Arbor, MI; David J. DiSantis, MD, DePaul Medical Center, Norfolk, VA; Seth Glick, MD, Hehnamann University Hospital, Philadelphia, PA; Marc Levine, MD, Hospital of the University of Pennsylvania, Philadelphia, PA; Alec J. Megibow, MD, MPH, New York University Medical Center, New York, NY; Sanjay Saini, MD, Massachusetts General Hospital, Boston, MA; William Shuman, MD, Evergreen Hospital Medical Center, Kirkland, WA; Frederick Leslie Greene, MD, Carolinas Medical Center, Charlotte, NC, American College of Surgeons; Loren Laine, MD, LAC & USC Medical Center, Los Angeles, CA, American Gastroenterological Association; Keith Lillemoe, MD, The Johns Hopkins Hospital, Baltimore, MD, American College of Surgeons.

Expert Panel on Interventional Radiology. Jonathan Levy, MD, Chair, Scottsdale Memorial Hospital, Scottsdale, AZ; E. William Akins, MD, Naples Community Hospital, Naples, FL; Curtis Bakal, MD, Montefiore Medical Center, Bronx, NY; Donald Denny Jr., MD, Yale University School of Medicine, Princeton, NJ; Richard L. Duszak Jr., MD, West Reading Radiology Associates, Reading, PA; Louis Martin, MD, Emory University Hospital, Atlanta, GA; Arl Van Moore Jr., MD, Carolinas Medical Center, Charlotte, NC; Michael Pentecost, MD, Georgetown University Hospital, Washington, DC; Anne Roberts, MD, UCSD Medical Center, Thornton Hospital, La Jolla, CA; Robert Vogelzang, MD, Northwestern Memorial Hospital, Chicago, IL; K. Craig Kent, MD, New York Hospital, New York, NY, Society of Vascular Surgery; Martin I. Resnick, MD, University Hospital of Cleveland, Cleveland, OH, American Urological Association; Jerome Richie, MD, Brigham and Women's Hospital, Boston, MA, American Urological Association. Bruce A. Perler, MD, The Johns Hopkins Hosptial, Baltimore, MD, Society of Vascular Surgery.

Expert Panel on Musculoskeletal Imaging. Murray Dalinka, MD, Chair, University of Pennsylvania Hospital, Philadelphia, PA; Naomi Alazraki, MD, VA Medical Center-Atlanta, Decatur, GA; Thomas Berquist, MD, Mayo Clinic, Jacksonville, FL; Richard Daffner, MD, Allegheny Hospital, Pittsburgh, PA; Arthur DeSmet, MD, University of Wisconsin, Madison, WI; George El-Khoury, University of Iowa Hospitals and Clinics, Iowa City, IA; Thomas G. Goergen, MD, Palomar Medical Center, Escondido, CA; Theodore Keats, MD, University of Virginia School of Medicine, Charlottesville, VA; B.J. Manaster, MD, PhD, University of Colorado Health Sciences Center, Denver, CO; Arthur Newberg, MD, New England Baptist Hospital, Boston, MA; Helene Pavlov, MD, Hospital for Special Surgery, New York, NY; Robert Haralson III, MD, Maryville Orthopedic Clinic, Maryville, TN, American Academy of Orthpedic Surgeons; John McCabe, MD, SUNY Health Science Center, Syracuse, NY, American College of Emergency Physicians; David Sartoris, MD, Thornton Hospital, La Jolla, CA.

Expert Panel on Neurological Imaging. Burton Drayer, MD, Chair, Mt. Sinai Medical Center, New York, NY; Robert Anderson, MD, Winter Park, FL; Bruce Braffman, MD, Memorial Regional Hospital, Hollywood, FL; David Collier, MD, Medical College of Wisconsin, Milwaukee, WI; Patricia Davis, MD, Egleston Children's Hospital, Atlanta, GA; Michael Deck, MD, New York Hospital, Cornell Medical Center, New York, NY; Anton Hasso, MD, University of California Irvine Medical Center, Orange, CA; Blake Johnson, MD, Center for Diagnostic Imaging, St. Louis Park, MN; Thomas Masaryk, MD, Shaker Heights, OH; Stephen Pomeranz, MD, MRI Education Foundation, Cincinnati, OH; David Seidenwurm, MD, Radiological Associates of Sacramento, Sacramento, CA; Lawrence Tanenbaum, MD, New Jersey Neuroscience Institute, Edison, NJ; Joseph Masdeu, MD, PhD, St. Vincent's Hospital, New York, NY, American Academy of Neurology.

Expert Panel on Pediatric Imaging. David Kushner, MD, Chair, Children's National Medical Center, Washington, DC; Diane Babcock, MD, Children's Hospital Medical Center, Cincinnati, OH; Harris Cohen, MD, SUNY HSC at Brooklyn, Brooklyn, NY; Michael Gelfand, MD, Children's Hospital Medical Center, Cincinnati, OH; Ramiro Hernandez, MD, C.S. Mott Children's Hospital, Ann Arbor, MI; William McAlister, MD, Mallinckrodt Institute of Radiology, St. Louis, MO; Bruce Parker, MD, Texas Children's Hospital, Houston, TX; Stuart Royal, MD, The Children's Hospital, Birmingham, AL; Thomas Slovis, MD, Children's Hospital of Michigan, Detroit, MI; Wilbur Smith, MD, Henry Ford Hospital, Detroit, MI; John Strain, MD, The Children's Hospital, Denver, CO; Janet Strife, MD, Children's Hospital Medical Center, Cincinnati, OH; Neil Feins, MD, New England Medical Center, Boston, MA, American Pediatric Surgical Association; David Joseph, MD, University of Alabama, Birmingham, AL, American Academy of Pediatrics; A. David Rothner, MD, Cleveland Clinic, Cleveland, OH, American Academy of Pediatrics; H. Gil Rushton, MD, Children's National Medical Center, Washington, DC, American Academy of Pediatrics; Laura Tosi, MD, Children's National Medical Center, Washington, DC, American Academy of Orthopedic Surgeons. William Rodriguez, MD, Children's National Medical Center, Washington, DC, American Academy of Pediatrics.

Expert Panel on Thoracic Imaging. Jack Westcott, MD, Chair, Hospital of St. Raphael, New Haven, CT; Howard Fleishon, MD, Valley Radiologists, Glendale, AZ; Warren Gefter, MD, Hospital of University of Pennsylvania, Philadelphia, PA; Claudia Henschke, MD, PhD, Cornell Medical Center, New York, NY; Reese James, MD, St. John Medical Center, Tulsa, OK; Theresa McLoud, MD, Massachusetts General Hospital, Boston, MA; Robert Pugatch, MD, UMMS, Baltimore, MD; Henry Dirk Sostman, MD, Cornell Medical Center, New York, NY; Irena Tocino, MD, Yale University School of Medicine, New Haven, CT; Charles White, MD, University of Maryland Hospital, Baltimore, MD; David Yankelevitz, MD, New York Presbyterian Hospital, New York, NY; Frederick Bode, MD, University of Missouri-Columbia, Columbia, MO, American College of Chest Physicians; Joseph Hildner, MD, Belleview FL, American Academy of Family Physicians; David Powner, MD, University of Pittsburgh, Pittsburgh, PA, Society of Critical Care Medicine.

Expert Panel on Urologic Imaging. E. Stephen Amis, Jr., MD, Chair, Montefiore Medical Center, Bronx, NY; Lawrence Bigongiari, MD, Texarkana, TX; Edward Bluth, MD, Ochsner Clinic, New Orleans, LA; William Bush Jr., MD, University of Washington School of Medicine, Seattle, WA; Peter Choyke, MD, National Institutes of Health, Bethesda, MD; Peggy Fritzsche, MD, Riverside MRI Center, Riverside, CA; Lawrence Holder, MD, University of Maryland Hospital, Baltimore, MD; Jeffrey Newhouse, MD, Columbia Presbyterian Medical Center, New York, NY; Carl Sandler, MD, University of Texas School of Medicine, Houston, TX; Arthur Segal, MD, Rochester General Hospital, Rochester, NY; Martin Resnick, MD, University Hospital of Cleveland, Cleveland, OH, American Urological Association; Edwin Rutsky, MD, University of Alabama, Birmingham, AL, American Society of Nephrology.

Expert Panel on Women's Imaging, Breast Work Group. Ellen Mendelson, MD, Chair, Western Pennsylvania Hospital, Pittsburgh, PA; Lawrence Bassett, MD, UCLA School of Medicine, Los Angeles, CA; Marcela Bohm-Velez, MD, Western Pennsylvania Hospital, Pittsburgh, PA; Gilda Cardenosa, MD, The Cleveland Clinic Foundation, Cleveland, OH; Carl D'Orsi, MD, University of Massachusetts Medical Center, Worcester, MA; W. Phil Evans III, MD, Baylor-Komen Breast Cancer Institute, Dallas, TX; Barbara Monsees, MD, Mallinckrodt Institute of Radiology, St. Louis, MO; Amy Thurmond, MD, Legacy Meredian Park Hospital, Tualatin, OR; Steven Goldstein, MD, New York University Medical Center, New York, NY, American College of Obstetrics and Gynecology.

Expert Panel on Women's Imaging, Women's Work Group. Ellen Mendelson, MD, Chair; Marcela Bohm-Velez, MD; Robert Bree, MD, University of Michigan Medical Center, Ann Arbor, MI; Harris Finberg, MD, Phoenix Perinatal Associates, Phoenix, AZ; Elliot Fishman, MD, The Johns Hopkins Hospital, Baltimore, MD; Hedvig Hricak, MD, PhD, University of California San Francisco, San Francisco, CA; Faye Laing, MD, Brigham and Women's Hospital, Boston, MA; David Sartoris, MD, Thornton Hospital, La Jolla, CA; Amy Thurmond, MD; Steven Goldstein, MD.

Expert Panel on Radiation Oncology. Steven Leibel, MD, Chair, Memorial Sloan-Kettering Cancer Center, New York, NY. *Lung Work Group.* William Sause, MD, Chair, LDS Hospital, Salt Lake City, UT; Roger Byhardt, MD, Zablocki VA Hospital, Milwaukee, WI; Walter Curran, Jr., MD, TJUH Bodine Cancer Center, Philadelphia, PA; Donald Fuller, MD, Radiation Medical Group, San Diego, CA; Mary Graham, MD, Phelps County Regional Medical Center, Rolla, MO; Benny Ko, MD, St. Francis South Campus Cancer Care Center, Indianapolis, IN; Ritsuko Komaki, MD, M.D. Anderson Cancer Center, Houston, TX; Thomas Weisenburger, MD, Cancer Foundation of Santa Barbara, Santa Barbara, CA; Larry Kaiser, MD, University of Pennsylvania Medical Center, Philadelphia, PA, Society of Thoracic Surgeons.

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answer the question. An editorial recently published in the Journal of the American Medical Association recently summarized the barriers to implementation of guidelines in general (6). Some of the factors raised include: the guidelines might be ignored; they may not be applicable in all settings ("not portable"); they may be misapplied; they may be so narrowly focused as to not have any significant impact; and they may have an unintended negative effect. For example, if MR is favored to a small degree over CT in a given circumstance where MR accessibility is limited, there might be an unintended increase in length of hospital stay. One added major factor is the problem of information transfer. With hundreds of appropriateness criteria available, with hundreds more variations, how can any individual be expected to learn and remember them all? Distributing the information on the Internet and making the criteria adaptable for individual personal computers and intranets, should make the information more accessible.

In summary, the ACR has undertaken the task of developing recommendations for appropriate diagnostic and treatment decisions involving radiologic procedures. The project is an example of volunteerism at its best, with radiologists and physicians from other specialties contributing extensive time and effort. We believe these contributions as well as the cost and staff support of the ACR have been worthwhile and we look

Table 5. ACR Appropriateness Criteria Task Force Medical Specialty Organization Participants

American Academy of Family Physicians	American Gastroenterological Association
American Academy of Neurology	American Pediatric Surgical Association
American Academy of Orthopedic Surgeons	American Society of Clinical Oncology
American Academy of Pediatrics	American Society of Nephrology
American Association of Neurological Surgeons	American Urological Association
American College of Cardiology	Pediatric Orthopedic Society of North America
American College of Chest Physicians	Society of Critical Care Medicine
American College of Emergency Physicians	Society of Thoracic Surgeons
American College of Obstetrics and Gynecology	Society of Vascular Surgery
American College of Surgeons	

forward to future health services research on the subject. We hope that the results of these efforts will contribute to achievement of the most safe (7) and cost effective radiology possible.

REPRESENTATIVE TOPICS OF APPROPRIATENESS CRITERIA

As a part of this supplement, we are sharing a portion of the work of the diagnostic, interventional, and radiation oncology panels to provide examples of the work of the Expert Panels. A representative topic with all its variants is included from each panel. The topics included are:

1. Suspected Bacterial Endocarditis written by Charles B. Higgins, M.D., from the Expert Panel on Cardiovascular Imaging.
2. Acute Abdominal Pain and Fever written by William P. Shuman, M.D., from the Expert Panel on Gastrointestinal Imaging.
3. Percutaneous Tube Drainage of Infected Intra-Abdominal Fluid Collections written by Edward Priest, II, M.D., from the Expert Panel on Interventional Imaging.
4. Chronic Elbow Pain written by Thomas G. Goergen, M.D., from the Expert Panel on Interventional Imaging.
5. Uncomplicated Low Back Pain written by Robert E. Anderson, M.D., from the Expert Panel on Neurological Imaging.
6. Sinusitis in the Pediatric Population written by William H. McAlister, M.D., and Bruce Parker, M.D., from the Expert Panel on Pediatric Imaging.
7. Hemoptysis written by Howard Fleishon, M.D., and Lawrence Goodman, M.D., from the Expert Panel on Thoracic Imaging
8. Obstructive Voiding Symptoms Secondary to Prostate Disease written by Edward Bluth, M.D., from the Expert Panel on Urologic Imaging
9. Endometrial Cancer of the Uterus written by Hedvig Hricak, M.D., Ph.D., from the Expert Panel on Women's Imaging.
10. Nonsurgical, Aggressive Therapy for NSCLC written by Ritsuko Komaki, M.D., and Noah C. Choi, M.D., from the Lung Work Group of the Expert Panel on Radiation Oncology.

Table 6. The Principles of Setting Guidelines

In establishing the ACR Appropriateness Criteria™, the Task Force incorporated attributes for developing acceptable medical practice guidelines used by the Agency for Healthcare Policy and Research (AHCPR) as developed by the Institute of Medicine. These eight attributes were followed to the degree possible by the ACR consensus panels. These attributes are:

Validity: Guidelines are valid if they lead to better outcomes. Validity assessment should be based on the quality of the scientific evidence and the method of evidence evaluation.

Reliability/Reproducibility: Another set of experts should be able to produce similar guidelines when using the same methodology to evaluate the same scientific evidence.

Clinical Applicability: Guidelines should include an explicit description of the applicable patient population.

Clinical Flexibility: Guidelines must specify known or expected exceptions.

Clarity: Guidelines must be unambiguous with clearly defined terms. They should be presented in a logical manner and be easy to follow.

Multidisciplinary Process: Affected provider groups should have representation in the guideline development process.

Scheduled Review: All guidelines should undergo scheduled review to determine whether revision is indicated based on current scientific evidence.

Documentation: The development procedure, the participants, the evidence, and the methods of analysis should be documented.

The AHCPR is explicit in stating its intent that scientific evidence should be used as much as possible but that judgment and group consensus will be necessary in the development of medical guidelines/appropriateness criteria

SUSPECTED BACTERIAL ENDOCARDITIS: SUMMARY OF LITERATURE REVIEW (TABLES 7&8)

Introduction

Infective endocarditis has been classified as acute endocarditis and subacute endocarditis. Typically, acute endocarditis is produced by a virulent organism (such as staphylococcus aureus) on a normal valve, while subacute endocarditis is produced by less virulent organisms (streptococcus viridans or staphylococcus epidermis) on an abnormal valve. Infectious endocarditis can also be classified as infection of prosthetic valves. In recent years, infectious endocarditis of normal right-sided valves has become frequent as a consequence of intravenous injection of illicit drugs. While acute endocarditis of left-sided cardiac valves nearly invariably causes congestive heart failure, heart failure may also occur with subacute infectious endocarditis. The diagnostic work-up of patients with suspected infectious endocarditis varies somewhat depending upon the presence of congestive heart failure.

Infectious endocarditis is fundamentally a clinical diagnosis based upon the presence of positive blood cultures in association with characteristic symptoms and physical findings. Imaging is used to support the diagnosis by demonstration of vegetations of cardiac valves and in complicated cases, perivalvular abscesses. Imaging is also used to assess the severity of valvular damage, identify complications and recognize the presence and severity of heart failure.

Chest X-Ray

The chest x-ray is used to determine cardiac chamber size and the presence and severity of pulmonary venous hypertension and edema; it is necessary for the evaluation of infective endocarditis. It is used to monitor the severity of the hemodynamic consequences of valvular regurgitation caused by infectious endocarditis and to assess response to treatment. Chest x-ray is also used to identify abnormal contour of the great arteries or cardiac chambers which might be indicative of perivalvular abscess. In right-sided endocarditis the chest x-ray is effective for demonstration of pulmonary infarcts and abscesses.

Cardiac Fluoroscopy

Cardiac fluoroscopy may be indicated for the evaluation of prosthetic cardiac valves afflicted with endocarditis. It is used to determine excess mobility of the valve during the cardiac cycle; this finding may be highly suggestive of valve dehiscence caused by infective endocarditis.

Transthoracic Echocardiography

Transthoracic echocardiography (TTE) is necessary in the evaluation of infective endocarditis. Transthoracic echocardiography can demonstrate vegetations on cardiac valves, valvular regurgitation, and perivalvular abscess. It is the most frequently employed imaging study for confirming the diagnosis of infective endocarditis. The demonstration of vegetations by echocardiography establishes the diagnosis (11). A recent study has shown that criteria for the diagnosis, which includes the findings on TTE or transesophageal echocardiography (TEE), were significantly better than traditional criteria based upon clinical and bacteriologic criteria (13,14). While TEE has been shown to have significantly higher sensitivity than TTE for identifying vegetations(16), specificities were similar. The positive predictive value of echocardiography for the diagnosis has been shown to be 97% while the negative predictive value was 94% (27).

A recent study evaluated the diagnostic value of TTE and

Table 7. ACR Appropriateness Criteria™ - Clinical condition: Suspected Bacterial Endocarditis, Variant 1: With Signs of Congestive Heart Failure

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest X-ray	9	
Transthoracic Echocardiography with Doppler	8	
Transthoracic Echocardiography without Doppler	6	
Transesophageal Echocardiography	6	Only for prosthetic valves or TTE nondiagnostic or TTE inadequate.
MRI	6	Probably indicated to rule out paravalvular abscess.
Cardiac Catheterization and Angiography	6	Indicated pre-operatively.
Electron Beam CT	4	
CT	4	
Indium-labeled WBC Study	4	
Cardiac Series	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 8. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Suspected Bacterial Endocarditis Variant 2: Without Signs of Congestive Heart Failure

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest X-ray	9	
Transthoracic Echocardiography with Doppler	8	
Transthoracic Echocardiography without Doppler	6	
Transesophageal Echocardiography	6	
MRI	6	
Electron Beam CT	4	
CT	4	
Indium-labeled WBC Study	4	
Cardiac Catheterization and Angiography	4	
Cardiac Series	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

TEE in relation to the pretest probability of infective endocarditis based upon clinical assessment (8). This study concluded that echocardiography is not indicated in patients with low probability of endocarditis. TTE is the procedure of choice for patients with intermediate or high probability of endocarditis. It concluded also that TEE should be reserved for patients with prosthetic valves or when TTE yields intermediate probability results. In right-sided endocarditis, TTE and TEE demonstrated a similar number of vegetations and frequency of tricuspid regurgitation (19).

The size and other characteristics of vegetations on echocardiography have been shown to be useful in predicting complications such as peripheral embolization. Increase or failure to decrease in size of vegetation on serial echocardiograms during antibiotic therapy has been shown to be predictive of a prolonged and/or complicated course of infective endocarditis (25).

Transesophageal Echocardiography

Transesophageal echocardiography is indicated in suspected infective endocarditis (IE) for demonstrating vegetations, perivalvular abscess, valvular regurgitation and ventricular function. It is the most sensitive imaging technique for identifying vegetations, which are the hallmark for the definitive diagnosis of infective endocarditis (11,23). Criteria for the diagnosis of IE using echocardiographic features improves upon the diagnostic accuracy of using clinical criteria alone (13,14). TEE has better sensitivity than TTE for detecting vegetations (16). A recent review has claimed that in experienced hands, TEE has a greater than 90% sensitivity and specificity for detecting intracardiac lesions associated with IE (18). This review also concluded that a negative TEE almost always means a very low probability of IE (18).

TEE has been shown to be very effective for monitoring the size and other characteristics of vegetation and for detecting complications such as perivalvular abscesses (10-12,16). TEE has improved sensitivity and accuracy compared to TTE for identifying perivalvular abscesses (10). TEE is indicated for suspected IE of prosthetic valves; it is significantly more accurate than TTE for examination of prosthetic valves (8,23). Furthermore, monitoring the size of vegetations during treatment contributes information concerning prognosis and risk of complications (25).

In a recent study, TTE was found to be the more cost effective test in patients with intermediate or high pretest probability of IE (8). This study concluded that TEE should be reserved for patients with suspected IE on prosthetic valves or those in whom TTE yields intermediate probability results.

TEE is indicated in many patients with suspected IE, especially those in whom TTE is inconclusive or in patients with suspected perivalvular abscess.

Radioisotope Scanning

Radioisotope scanning is probably indicated in the evaluation of suspected infective endocarditis. Several types of radioisotope scans may be used for identifying and localizing infected vegetations and perivalvular abscesses. Gallium-67 and indium-111 labeled white cells are routinely available for localizing vegetations and abscesses (29). Although these techniques are useful in isolated patients, they have a low sensitivity and add little to the usual diagnosis of infective endocarditis.

More recently, immunoscintigraphy using technetium-99m labeled anti-NCA-95 antigranulocyte antibodies has been proposed as a method of localization (15,24). In one study this

scan had a sensitivity of 79% and specificity of 82% compared to echocardiography with a sensitivity of 88% and specificity of 97% (15). However, the combination of echocardiography and immunoscintigraphy has a sensitivity and specificity of 100% and 82% respectively.

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) is probably indicated for the evaluation of infective endocarditis (17,30). However, its use should be limited to the evaluation of complications of infective endocarditis such as perivalvular and myocardial abscesses and infectious pseudoaneurysms. It is less accurate than TTE and TEE for identifying valvular vegetations. Cine MRI and velocity encoded cine MRI can be used for the semi-quantification and quantification of the volume of valvular regurgitation, respectively (31).

Computed Tomography

Standard CT and electron beam CT are probably indicated in the evaluation of complications of infective endocarditis, such as the identification of perivascular and myocardial abscesses and infective pseudoaneurysms. CT may be indicated in right-sided endocarditis for demonstrated septic pulmonary infarcts and abscesses.

CT is less accurate than TTE and TEE for identifying valvular vegetation. Consequently, the role of CT, like MRI, is for the evaluation of complicated cases of infective endocarditis.

Catheterization and Ventricular Angiography

Catheterization and ventriculography is indicated in infective endocarditis with congestive heart failure. It may be used to assess the severity of valvular dysfunction and ventricular function prior to surgery. These tests are not indicated for patients with uncomplicated endocarditis on native valves in whom surgical intervention is not contemplated. Catheterization and ventriculography may be indicated for endocarditis of prosthetic valves when echocardiographic results are equivocal.

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Date for next review: 2002.

IMAGING EVALUATION OF PATIENTS WITH ACUTE ABDOMINAL PAIN AND FEVER: SUMMARY OF LITERATURE REVIEW (TABLES 9&10)

Introduction

Acute abdominal pain with fever implies the threat of a rapidly progressive process which may need immediate surgical or medical attention. In these circumstances, there is considerable pressure to use imaging and other information to make an expedited and accurate diagnosis since quickly instituting the correct therapy may improve outcome. Infection or other type of inflammation is implied. This abdominal appropriateness category is arbitrarily limited to the region between the diaphragm and the upper pelvis and excludes both renal/flank pathology and children.

The range of pathology which can produce abdominal pain and fever is very broad. It includes pneumonia, hepatobiliary disease, complicated pancreatic processes, perforations or inflammations of gut, bowel obstruction or infarction, abscesses anywhere in the abdomen, and tumor – among others. Of all patients who present to an emergency room with abdominal pain, about one third never have a diagnosis established, one third have appendicitis, and one third have some other documented pathology. In this latter "other" category the most common entities include (in order of frequency): acute cholecystitis, small bowel obstruction, pancreatitis, renal colic, perforated peptic ulcer, cancer, and diverticulitis (32). When any of these problems are complicated by fever, the pressure to diagnose quickly and definitively is much increased.

There are various clinical presentations of patients with acute abdominal pain with fever. As acute right upper quadrant pain, acute right lower quadrant pain, acute left lower quadrant pain have already been considered, we will concentrate on the evaluation of acute diffuse abdominal pain, and acute abdominal pain in the HIV positive patient in this review. Imaging workup varies slightly among different circumstances of presentation. In general, CT will have a preeminent role in the evaluation of patients with abdominal pain, more so in those with fever. Two reports have found CT superior to clinical evaluation for finding the cause of abdominal pain. CT was

Table 9. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Abdominal Pain and Fever, Variant 1: Acute diffuse abdominal pain and fever

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain Films	8	
CT with oral and IV contrast	8	Rectal contrast may be a useful addition in certain circumstances.
CT without oral or IV contrast	6	
Ultrasound	6	
Radionuclide Scan Tc-99m-HMPAOLeukocytes	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 10. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Abdominal Pain and Fever, Variant 2: Acute abdominal pain and fever in the HIV positive patient

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain Films	8	
CT with oral, rectal, and IV contrast	8	
Biliary Ultrasound	8	
Barium Enema	6	Can be useful to look at colonic mucosal pattern.
Upper GI series with SBFT	6	Can be useful to look at small bowel mucosal pattern.
Radionuclide Scan Tc-99m-HMPAOleukocytes	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

correct in 90-95% of cases while clinical evaluation was correct in 60-76% (33,34). Abdominal CT without the use of oral or IV contrast has been advocated recently as an alternative to plain films of the abdomen (32); however the spectrum of detectable pathology greatly increases with the use of contrast agents.

Acute diffuse abdominal pain with fever can be caused by conditions that ordinarily lead to more localized types of pain. These conditions include complicated appendicitis, complicated acute calculous or acalculous cholecystitis, bile duct obstruction with infectious cholangitis, hepatitis, hepatic abscess, pancreatitis, ureteral calculous, omental infarction, and diverticulitis. Other conditions that typically present with diffuse abdominal pain and fever include bowel obstruction, bowel ischemia or infarction, gut perforation from ulcer or tumor, diffuse colitis, small bowel inflammatory disease, abdominal abscess, and diffuse malignancy.

Again, plain films may provide useful information about bowel gas pattern or free air, but they offer no incremental information if CT is performed. Sonography may be useful in selected conditions, including cholecystitis, cholangitis, liver abscess, appendicitis and small bowel inflammation, where it may be used to assess activity of Crohn's disease. While ultrasound may be able to detect portions of an abscess or malignancy (such as lymphoma), it is blind to many areas of the abdomen, particularly in the presence of increased bowel gas or free air.

In patients with high grade bowel obstruction, CT sensitivity varies from 86% to 100%, with slightly lower sensitivity reported for low grade obstruction (35-37). In this regard, CT considerably outperforms the combination of clinical evaluation and plain films (36). CT also has the ability to identify and localize the cause of obstruction in 73%-95% of cases (35-37). Additionally, CT can identify closed loop obstruction (sensitivity 79%) and associated strangulation (sensitivity 67%) (38). For intestinal ischemia, reported sensitivity of CT varies from 65% to 86% (39,40) based on findings of vessel thrombosis, intramural or portal gas, and lack of bowel wall enhancement. For intestinal infarction, CT sensitivity (82%) considerably outperformed plain film plus ultrasound sensitivity (28%) (41). In gut perforation, while plain films are sensitive to small volumes of free air, CT is more sensitive to even smaller volumes and can detect additional loculated air or air in the mesenteric root (42). Other CT findings include extravasation of oral contrast, mesenteric edema, or phlegmonous mass adjacent to a site of perforation. In patients with Crohn's disease or inflammatory colitis, the presence of fever raises the question of associated abscess or phlegmon. CT is the procedure of choice for the diagnosis of abscess, regardless of cause, and for showing the location and full extent (43,44). Similarly, CT is required to show the extent of any related fistulas or sinus tracts (44,45). Pseudomembranous colitis may have fever without abscess; CT findings are present in the colon in 88% of cases (46). While Tc-99m HMPAO white cell labeled scanning has a high sensitivity for inflammatory bowel disease (91-98%) (47,48), it does not do as well as CT in detecting the complications of abscess and fistula (49). Rarely, diffuse tumor such as lymphoma or metastases may present with abdominal pain and fever; again, CT is the procedure of choice due to its ability to assess well all node groups and organs.

Acute Abdominal Pain with Fever in the HIV Positive Patient

Next, let us consider acute diffuse abdominal pain with fever in the HIV positive patient. Common pathological entities with this clinical presentation are broader in spectrum and include typhlitis, intramural gut hemorrhage, and small bowel or colonic perforation with associated abscess. The hepatobiliary region may be involved with HIV related cholangiopathy, hepatic abscesses, or psliosus hepatis (bacillary angiomatosis). The spleen is subject to focal infarction or abscess. Gut mucosal disease may include GI tuberculosis, ulcerating colitis (CMV, Clostridium difficile), MAI related enteritis, and opportunistic bowel infection (cryptospiridiosis, Giadia, Isospora, and Strongyloides). Tumors with adenopathy and bowel involvement include Kaposi's sarcoma or lymphoma of gut, either of which may lead to bowel obstruction, pneumatosis intestinalis, perforation, or intussusception (50).

For virtually all of the pathologies mentioned above, CT with oral, IV, and (frequently) rectal contrast is the first proce-

dure of choice in a HIV positive patient with acute abdominal pain and fever (50-52). Supplemental barium studies of the mucosa of the stomach, small bowel, and colon may add additional information to that from CT, particularly when mucosal lesions are small and fine. If there is any chance of gut perforation, barium should not be used. Occasionally, ultrasound of the biliary tree and gallbladder may be marginally useful after CT in the evaluation of HIV related cholangitis. If CT is performed, plain films should have little incremental value. The use of radionuclide scanning in this subgroup has not been reported.

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PERCUTANEOUS TUBE DRAINAGE OF INFECTED INTRA-ABDOMINAL FLUID COLLECTIONS: SUMMARY OF LITERATURE REVIEW (TABLES 11-14)

Introduction

Since its introduction in the early 1980's, percutaneous image-guided tube drainage has gained acceptance by the medical community at large as the treatment of choice for most infected intra-abdominal fluid collections. Several large clinical series have documented the ability of percutaneous abscess drainage (PAD) to treat intra-abdominal abscesses from a number of causes (53-58,60,61,73,76). Consistent and reproducible success rates of 70-93%, complication rates of 1-15% and mortality rates of 1-11% have been reported (Ibid). Careful review of these non-randomized, after retrospective clinical series shows that differences in results are probably due to variances in patient acuity and general health, abscess location, abscess morphology, and presence/absence of fistula.

Prior to PAD, the "gold standard" for treatment of intra-abdominal abscess was open surgical drainage (OSD). Historical OSD success has been reported to range from 51-70% with mortality rates of 11-43%. Complication rates have been reported between 4-35% (53-56,76).

Although PAD fares well in this comparison, the well-known problems with matching the important variables between clinical series from multiple times and places have called the validity of such a comparison into question. Furthermore, no prospective, randomized studies exist. Indeed, Gerzof and Olak have stated that such a study would be "unethical" (54).

To address these methodological shortcomings, two relatively recent reports have used a retrospective case-controlled format to compare PAD and OSD. Olak, et al, studied 27 PAD-treated and 27 OSD-treated abscesses matched for abscess location, abscess etiology and patient acuity. His group found similar mortality (11% vs. 7.4%), morbidity (29% vs. 40%), and successful treatment rates (70% vs. 85%). Hemming, et al, in a 1990 study, reported similar results in an 83 patient study which

Table 11. ACR APPROPRIATENESS CRITERIA™ - Interventional Procedure: Percutaneous Tube Drainage of Infected Intra-abdominal Fluid Collections, Variant 1: PAD of liver abscess

Presentation/Signs/Symptoms	Appropriateness Rating	Comments
HISTORY:		
Pain	8	
Systemic infection symptoms	8	
Trauma	6	
Known cancer	4	
No-Inappropriate antibiotics	2	
Asymptomatic	No Consensus	
PHYSICAL EXAMINATION:		
Focal abdominal findings	8	
Ascites	4	
LABORATORY FINDINGS:		
Gram stain(+)	8	
Gram stain (-)	6	
Uncorrected bleeding disorder	4	
FNA biopsy (+) for cancer	3	
Ameobic titre > 1:32	2	
IMAGING EXAMINATIONS:		
Deep lesion with ascites	2	
Multiple small (2 cm or less) lesions	2	
No safe route on CT	2	
OTHER:		
Poor surgical risk	8	
Multiorgan system failure syndrome	8	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 12. ACR APPROPRIATENESS CRITERIA™ - Interventional Procedure: Percutaneous Tube Drainage of Infected Intra-abdominal Fluid Collections, Variant 2: PAD of Infected pancreatic fluid collection

Presentation/Signs/Symptoms	Appropriateness Rating	Comments
HISTORY:		
Pain	8	
Systemic infection symptoms	8	
Trauma	6	
Asymptomatic	4	
Known cancer	4	
NO-Inappropriate antibiotics	2	
PHYSICAL EXAMINATION:		
Focal abdominal findings	6	
Ascites	4	
LABORATORY FINDINGS:		
Gram stain (+)	8	
Gram stain (-)	4	
FNA biopsy (+) for cancer	2	
Uncorrected bleeding disorder	2	
IMAGING EXAMINATIONS:		
Abscess	8	
Pseudocyst	8	
Ascites	4	
Phlegmon	2	
OTHER:		
Poor surgical risk	8	
Multiorgan system failure syndrome	6	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

compared 42 PAD vs. 41 OSD treated abscesses. Cases were matched for age, abscess location, and etiology as well as severity of illness according to APACHE II scores. Hemming found a PAD vs. OSD mortality of 12 vs. 14% and morbidity of 29 vs. 26%. PAD was successful in 93% of cases. Surgical success was not clearly stated, but 2 of 41 patients died of fistula-related complications after OSD (54). Assuming no reoperations (no figure was stated), OSD success can be calculated at 96%. One other comment regarding methodology is warranted. Despite widespread anecdotes and frequent literature testimonials to the temporizing value of PAD, no hard data exists that proves a better outcome in patients treated with this intent, except for several documented cases in which PAD enabled successful and uncomplicated single stage definitive surgical repair of periappendiceal abscesses and diverticular abscesses (60,65). In fact, no good definition of temporizing benefit has been put forth - lower anesthesia risk, fewer post-surgical complications, improved APACHE II score, shorter hospital stay, lower costs or lower mortality.

As PAD has grown in popularity, efforts to refine and extend the technique have identified several populations in which PAD is less effective, ineffective, or unneeded.

First it has been shown that "complex" abscess are less successfully cured than "simple" abscesses. Gerzof's criteria for PAD in his early landmark study defined a "simple" abscess as a unilocular, well defined fluid cavity whose infectious nature was diagnosed by Gram's stain and culture of fluid obtained by pre-drainage fine needle aspiration. His group and others achieved 85-93% success with PAD in this situation. Four years later, Gerzof reported on expanding these criteria to include complex (multilocular and extensively dissecting) abscesses or those associated with fistula or bowel perforation, splenic abscesses, and abscesses whose drainage route traversed normal organs. Only 45% of Gerzof's complex abscesses were cured, but other investigators have had better results, with complex abscess cure rates of 70-88% reported (56,57,60,62,63).

Second, a common denominator in the lower cure rate for complex abscesses is an association with pancreatitis (57,61,65,67,68,77). Distinguishing a true fluid collection from a phlegmonous, undrainable mass and removal of the large amounts of necrotic debris generated in infected pancreatic necrosis have been almost universally problematic with most reports citing less than 50% cure rate.

It should be noted, however, that surgery in infected pancreatic necrosis leaves much to be desired. Lang reported a prospective alternating-therapy trial of acuity-matched patients with pancreatic abscess in which PAD cured 3 of 18 but

Table 13. ACR APPROPRIATENESS CRITERIA™ - Interventional Procedure: Percutaneous Tube Drainage of Infected Intra-abdominal Fluid Collections, Variant 3: PAD for complex abscess

Presentation/Signs/Symptoms	Appropriateness Rating	Comments
HISTORY:		
Pain	8	
Systemic infection symptoms	8	
Trauma	6	
Asymptomatic	4	
Known cancer	4	
NO/Inappropriate antibiotics	2	
PHYSICAL EXAMINATION:		
High output fistula	8	
Low output fistula	8	
Focal abdominal findings	8	
Ascites	4	
LABORATORY:		
Gram stain (+)	8	
Gram stain (-)	6	
Uncorrected bleeding disorder	2	
FNA biopsy (+) for cancer	2	
More than 3 tubes required	2	
IMAGING EXAMINATIONS:		
Ascites	4	
No safe route on CT	2	
Deep lesion	No Consensus	
OTHER:		
Poor surgical risk	8	
Multiorgan system failure syndrome	7	
Associated surgical lesion	3	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1=Least appropriate, 9=Most appropriate

surgery only 4 of 15 (68). Bradley and Olsen, in their review of management of pancreatic abscess, cite mortality rates of 14-28% for surgical therapy. Infected pseudocysts, however, are relatively well treated by PAD with cure rates of 80-90% reported (77).

Third, PAD is unnecessary in liver abscess due to amoeba, since metronidazole therapy cures 94%, and in those abscesses due to GI or biliary disease correctable only with open surgery, such as diverticulitis or cholecystitis (72-74). In most cases these and other similar problems are best approached surgically with simultaneous surgical I & D of related abscesses. Therapeutic aspiration and antibiotics (without ongoing catheter drainage) may be adequate in cases of multiple small liver abscesses. PAD of pyogenic liver abscess may be unsafe if coagulopathy or ascites are present. Inmunocompromise and biliary fistula do not adversely affect outcome (74,75).

Fourth, although there are several case reports and small series of splenic abscess treated with PAD, this location has not been adequately studied for a conclusion to be reached (64,66).

Finally, PAD of infected necrotic tumors usually commits the patient to a life of tube dependency and is not recommended (64,66).

In summary, the following situations appear to be valid indications for PAD:

1. All simple abscesses with safe drainage routes (no traversal of uninvolved organs/structures and no direct contact between drainage tube and major blood vessels);
2 Most complex abscesses with safe drainage routs;
3. Pyogenic liver abscesses, single or limited in number;
4. Infected pseudocysts.

The following should probably be treated otherwise:

1. Amoeble and ecchinococcal hepatic abscesses;
2. Multiple small liver abscesses;
3. Liver or other deeply situated (8 cm. or greater from skin) abscesses with ascites or coagulopathy;
4. Pancreatic and splenic abscesses and infected necrotic tumors.

Table 14. ACR APPROPRIATENESS CRITERIA™ - Interventional Procedure: Percutaneous Tube Drainage of Infected Intra-abdominal Fluid Collections, Variant 4: PAD for simple abscess

Presentation/Signs/Symptoms	Appropriateness Rating	Comments
HISTORY:		
Pain	8	
Systemic infection (sepsis. fever, night sweats)	8	
Trauma	8	
Asymptomatic	7	
NO/Inappropriate antibiotics	2	
Known cancer	No Consensus	
PHYSICAL EXAMINATION:		
Focal abdominal findings	8	
Ascites	4	
LABORATORY FINDINGS:		
Gram stain (+)	8	
Gram stain (-)	7	
Uncorrected bleeding disorder	3	
FNA biopsy (+) for cancer	3	
IMAGING EXAMINATIONS:		
Deep lesion	7	
Ascites	4	
No safe route on CT	2	
OTHER:		
Poor surgical risk	8	
Multiorgan system failure syndrome	8	
Associated surgical lesion	3	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

PAD should be considered cautiously and with skepticism in non-curative settings except when attempting to create a sterile environment for single stage GI surgical repair or when surgical risk is thought to be excessive.

With regard to technique, confirmation of infection with Gram's stain, exclusion of tumor by cytology when clinically appropriate, predrainage treatment with appropriate antibiotics, meticulous delineation of disease, careful route planning (CT highly but anecdotally recommended by most authors for both these) and an amoebic indirect hemagglutination titre of less than 1:32 (liver only) are the keys to achieving success comparable to literature reports. Significant coagulopathies should be corrected pre-operatively.

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EVALUATION OF CHRONIC ELBOW PAIN – ADULT: SUMMARY OF LITERATURE REVIEW (TABLES 15-18)

Chronic elbow pain may be caused by a variety of osseous and/or soft tissue abnormalities. Before consideration of special imaging studies, most physicians would agree that plain films should be obtained. Most patients with chronic elbow pain will have had plain films and review of these studies may suffice. In some cases, the plain films may reveal the cause of the problem; e.g., intra-articular osteocartilagenous body. Although the diagnostic sensitivity of plain films in patients with chronic elbow pain is not known, plain films are relatively inexpensive. Conversely, exclusion of an osseous abnormality may be helpful when conservative therapy is planned. When the etiology of the chronic pain is uncertain and the patient has failed appropriate conservative therapeutic trials; e.g., anti-inflammatory medication, physical therapy, and/or steroid injection, other imaging studies may be considered. There are several articles which demonstrate the MRI findings in these disorders but the sensitivity, specificity and role of MRI imaging has not been established. Imaging choices will be considered for a variety of clinical conditions.

Osteochondral Lesion or Intra-articular Osteocartilagenous Body

Plain radiographs are required prior to other imaging studies and may be diagnostic for osteochondral fracture, osteochondritis dissecans, and osteocartilagenous intra-articular body (IAB). Plain tomography, single and double contrast arthrography with or without CT, and CT alone have been used for detection of an osteochondral lesion or IAB (89). All of these

Table 15. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Chronic Elbow Pain, Variant 1: Suspect intra-articular osteocartilagenous body; plain films non-diagnostic.

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT		
Arthrogram, double contrast	6	Depending on preference/availability of equipment.
Without intra-articular contrast	2	
Arthrogram, pos. contrast	2	
Arthrogram, air only	2	
MRI		
No intra-articular contrast	6	Depending on preference/availability of equipment.
Intra-articular contrast	2	
Tomography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 16. ACR APPROPRIATENESS CRITERIA™ -Clinical condition Chronic Elbow Pain, Variant 2: Suspect occult injury; e.g. osteochondral injury; plain films non-diagnostic.

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI		
No intra-articular contrast	9	
Intra-articular contrast	2	
CT		
Without intra-articular contrast	2	
Arthrogram, pos. contrast	2	
Arthrogram, air only	2	
Arthrogram, double contrast	2	
Tomography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

studies have limitations; for example, a small IAB may be obscured by contrast or confused with air bubbles (double contrast arthrography). More recently, MRI has been advocated as the initial study for suspected osteochondral fracture or IAB (78,81,85,90,94). Strengths of MRI include multiplanar format, non-invasive procedure, and ability to detect other osseous or soft tissue abnormalities. Regardless of method, detection of an IAB is limited by its size and location within the elbow joint. Detection of IAB is enhanced by the presence of joint effusion (83).

Tendon, ligament, muscle, nerve or other soft tissue abnormality

Magnetic resonance imaging may provide important diagnostic information for evaluation of the adult elbow in a variety of conditions including: collateral ligament injury, epicondylitis, injury to the biceps and triceps tendons, abnormality of the ulnar, radial or median nerve, and for masses about the elbow joint (78-88,90-94). There is a lack of studies showing the sensitivity and specificity of MR in many of these entities; most of the studies demonstrate MR findings in patients either known or highly likely to have a specific condition. In addition, there are no studies showing the utility of MR over clinical examination for diagnosis of ligament injury about the elbow. Thus, although MR is the only imaging modality able to diagnose abnormalities of the non-osseous tissues of the elbow, the value-added role of MR for diagnosis and treatment planning in many of these conditions has not been shown.

MR arthrography has been advocated to distinguish complete from partial tears of the ulnar collateral ligament (79). Epicondylitis (lateral - "tennis elbow" or medial - pitchers, golfers, and tennis players) is a common clinical diagnosis and MR imaging is usually not necessary (93). MR may be useful for confirmation of the diagnosis in refractory cases and to exclude associated tendon tear (83,84,86).

The ulnar nerve is particularly vulnerable to trauma from a direct blow in the region of its superficial location in the restricted space of the cubital tunnel. Anatomic variations of the cubital tunnel retinaculum may contribute to ulnar neuropathy. Axial T1-weighted images have been shown to depict the size

Table 17. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Chronic Elbow Pain, Variant 3: Suspect nerve entrapment or mass; plain films non-diagnostic.

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI		
Without contrast	9	
With contrast	2	
Without and with contrast	2	
No imaging indicated	2	
Ultrasound	2	
CT	2	
Radionuclide Bone Scan	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

and shape of the nerve and axial T2-weighted or STIR images may show increased signal in the presence of neuritis. Radial nerve and median nerve entrapment syndromes may also be evaluated with MR imaging (83,87,93).

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ACUTE LOW BACK PAIN, RADICULOPATHY: SUMMARY OF LITERATURE REVIEW (TABLES 19-24)

Introduction:

Acute low back pain (LBP) with or without radiculopathy (pain radiating down the leg(s)) is one of the commonest health problems in the nation and is the most common cause of disability for persons under the age of 45. The cost of evaluation and treatment of acute LBP (duration less than 3 months) runs into billions of dollars annually, not including time lost from work.

Due to the high prevalence and high cost of dealing with this problem, governmental agencies have sponsored extensive studies which are now part of the growing body of literature on this subject. One of the earlier comprehensive studies was carried out in Quebec and was reported in the journal *Spine* in 1987 (95). The U. S. Department of Health and Human Services recently convened a 23 member multidisciplinary panel of experts to review all of the literature on this subject, grade it, and to develop a "Clinical Practice Guideline" which was published in December, 1994 (96). States have convened similar panels in recent years, due largely to the rapidly rising workmen's' compensation claim burden being imposed on state budgets by LBP management. One of the more inclusive efforts was recently endorsed by the State of Florida, and is available by mail or on the Internet (97).

It is now clear from the above studies and others that uncomplicated acute low back pain is a benign, self-limited condition which does not warrant any imaging studies. The vast majority of these patients are back to their usual activities by 30 days (95-97). The challenge for the clinician, therefore, is to distinguish that small segment within this large patient population which should be evaluated further based upon suspicion of a more serious problem.

Indications of a more complicated status often termed "red flags", include the following (96):

Table 18. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Chronic Elbow Pain, Variant 4: Suspect ligament or tendon injury; plain films non-diagnostic.

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI		
Without contrast	9	
With contrast	2	
With intra-articular contrast	2	May be useful in selected cases for detection of partial ligament tear.
Stress films	2	
CT	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 19. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Uncomplicated Low Back Pain, Variant 1: No Red Flags

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain Lumbar X-Rays	2	
Isotope Bone Scan	2	
CT	2	
Myelogram	2	
Myelogram/CT	2	
Plain MRI	2	
MRI + Gadolinium	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

1. recent significant trauma, or milder trauma age >50
2. unexplained weight loss
3. unexplained fever
4. immunosuppression
5. history of cancer
6. IV drug use
7. prolonged use of corticosteroids, osteoporosis
8. age >70

Plain X-Rays:

Plain X-Rays are recommended when any of the above red flags are present (96,97).

Normal plain lumbar X-Rays may be sufficient for the initial evaluation of these red flags (96,97):

1. recent significant trauma (any age)
2. prolonged steroid use
3. osteoporosis
4. age >70

The initial evaluation of the LBP patient may require further imaging if red flags such as suspicion of cancer or infection are present (96,97).

Isotope Bone Scans:

The role of the isotope bone scan in patients with acute low back pain has changed in recent years with the wide availability of magnetic resonance imaging (MRI) and especially contrast-enhanced MRI. The bone scan is a moderately sensitive test for detecting the presence of tumor, infection or occult fractures of the vertebrae but not for specifying the diagnosis (96,97). The yield is very low in the presence of normal plain x-rays and laboratory studies, and highest in known malignancy (98). The test is contraindicated in pregnancy.

High resolution isotope imaging including SPECT may localize the source of pain in patients with articular facet osteoarthritis prior to therapeutic facet injection (99). Similar scans may be helpful in detecting and localizing the site of painful pseudoarthrosis in patients following lumbar spinal fusion (100).

Plain and contrast enhanced MRI has the ability to demonstrate inflammatory, neoplastic and most traumatic lesions as well as show anatomic detail not available on isotope studies. Gadolinium enhanced MRI reliably shows the presence and extent of spinal infection, and is useful in assessing therapy (101).

CT, MRI, Myelography, Myelography/CT:

Uncomplicated acute low back pain (no red flags) warrants the use of none of these imaging studies (95-97). The early indiscriminate use of expensive imaging procedures in this common clinical setting has caused large increases in workmen's

Table 20. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Low Back Pain, Variant 2: Trauma, steroids, osteoporosis, over 70

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain Lumbar X-Rays	8	
Plain MRI	5	
MRI + Gadolinium	4	
Isotope Bone Scan	4	
CT	4	
Myelogram	2	
Myelogram/CT	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 21. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Low Back Pain, Variant 3: Suspicion CA, Infection

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain MRI	8	
MRI + Gadolinium	7	
Plain Lumbar X-Rays	7	
Isotope Bone Scan	5	
CT	4	
Myelogram	2	
Myelogram/CT	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

compensation costs and in some cases has led to the perception that CT and MRI of the lumbar spine is not worth the cost. Adding to this controversy is the fact that non-specific lumbar disc abnormalities are common, and can be demonstrated readily on myelography, CT and MRI even in asymptomatic patients (102-105).

The appropriate use of these imaging procedures is an important challenge which has been extensively addressed in the major reviews referenced herein (95-97). For example, low back pain complicated by "red flags" suggesting infection or tumor may justify early use of CT or MRI even if plain x-rays are negative (96). The commonest indication for the use of these imaging procedures, however, is the clinical setting of LBP complicated by radiating pain (radiculopathy, sciatica) or cauda equina syndrome (bilateral leg weakness, urinary retention, saddle anesthesia), usually due to herniated disc and/or canal stenosis.

Plain Myelography:

Positive contrast myelography has been performed for decades for the evaluation of lumbar neuropathy. In reviewing studies in the literature designed to assess the efficacy of plain myelography, the U.S. expert panel found true positive rates between 68 and 96% for lumbar herniated disc corroborated at surgery (96).

CT, Myelography/CT, MRI:

Myelography followed by CT scan and MRI of the lumbar spine have largely replaced plain myelography for the evaluation of lumbar disc disease. A number of studies have been published comparing two or more of these tests. In summary, these studies found no major differences between CT, MRI, CT/Myelography in their ability to accurately diagnose disc herniation. All were superior to plain myelography (106-107).

CT and MRI were found of equal value in the evaluation of suspected lumbar spinal stenosis because of their ability to image the canal in the axial plane. Plain myelography was not as accurate in this setting (96-108).

CT and MRI are preferred over Myelography/CT since the latter required invasion of the subarachnoid space. Myelography/CT therefore is not recommended as an initial study but rather reserved for pre-operative planning.

Thermography, Discography, CT Discography:

Expert panels agreed that these imaging modalities were either too non-specific (thermography) or carried additional risk

Table 22. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Low Back Pain, Variant 4:Radiculopathy

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain MRI	8	
Myelogram/CT	5	
CT	5	
MRI + Gadolinium	4	
Plain Lumbar X-Rays	4	
Isotope Bone Scan	2	
Myelogram	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1= Least appropriate, 9 = Most appropriate

Table 23. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Low Back Pain, Variant 5: Prior Lumbar Surgery

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain MRI	7	
MRI + Gadolinium	7	Differentiate disc versus scar.
CT	5	To study fusion bone.
Isotope Bone Scan	5	Helps detect and localize painful pseudo arthrosis.
Plain Lumbar X-Rays	5	Flex/extension may be useful.
Myelogram/CT	5	
Myelogram	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

(discography) not warranted in view of the efficacy of other less invasive imaging procedures (96,97). When other studies fail to localize the cause of pain discography may occasionally be helpful. While the images often depict non-specific aging/ degenerative changes the injection itself may reproduce the patient's pain, which may have diagnostic value (109).

Approved date:September 1996.
Date for next review: September 1999.

Definitions:

Acute low back pain: Lumbosacral pain of less than 3 months duration.

Radiculopathy: Dysfunction of a nerve root usually caused by Compression of the root.

Spinal stenosis: Narrow bony canal which may cause radiculopathy, cauda equina syndrome.

Herniated disc: Herniation of the nucleus pulposus through the annulus fibrosis.

Sciatica: Pain radiating down the leg(s) below the knee along the distribution of the sciatic nerve, usually due to mechanical pressure and/or inflammation of lumbosacral nerve roots.

Cauda equina syndrome: Compression of multiple nerve roots often resulting in bilateral motor weakness (legs), urine retention, saddle anesthesia

Approved date: 1996.
Date for next review: 1999.

SINUSITIS IN THE PEDIATRIC POPULATION: SUMMARY OF LITERATURE REVIEW (TABLES 25-32)

Introduction

Sinusitis is a common problem in the pediatric population. The underlying factors which may lead to sinusitis in children include nasal airway obstruction, immunodeficiencies, alterations in the mucosa of the sinuses and nasal passageways, ciliary dysfunction and underlying conditions such as cystic fibrosis, allergic rhinitis, and immotile cilia syndrome (116,120,126, 127,136,138,140,147-149). The growing number of children in daycare centers has led to an increase in upper respiratory infections, which usually proceed acute sinusitis (120,149).

Table 24. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Acute Low Back Pain, Variant 6: Cauda Equina Syndrome

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain MRI	8	
MRI + Gadolinium	6	
Plain Lumbar X-Rays	5	
CT	4	
Myelogram/CT	4	May be requested pre-operatively.
Myelogram	2	
Isotope Bone Scan	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Recognition of the importance of sinus disease in children has been stimulated by the realization that sinus disease can have a negative impact on chronic pulmonary disease and is often a major complication of primary and acquired immunodeficiencies (132), which have increasing incidence and recognition. Not to be overlooked in the social and economic importance of sinusitis as parents often miss work caring for their children.

Although physicians vary in their understanding and ability to diagnose sinusitis clinically, a number of publications have detailed the signs and symptoms of acute, recurrent, and chronic sinusitis (120,147-149). The findings of sinusitis, especially chronic recurrent sinusitis, are non-specific (149). The most common signs and symptoms of sinusitis are upper respiratory infection with cough and purulent nasal drainage persisting beyond ten days (149). Infants and children almost universally have purulent nasal discharge with acute sinusitis. Acute sinusitis is a clinical diagnosis that may not need imaging (118).

Two main controversies surround imaging of sinusitis in the pediatric population. The first is the use of plain radiographs versus coronal CT scans (130,134,152). Plain radiographs, although having lower charges and more widely available, both under- and over diagnose sinus soft tissue change in the paranasal sinuses (130,134,150). In addition, the Caldwell projection does not localize ethmoid disease and the Water's projection does not show ethmoid involvement (133). Demonstration and localization of disease is essential for endoscopic sinus surgery; therefore, plain radiographs cannot be used as a guide for this procedure (133). Lateral sinus radiographs are of little value under the age of 4 years (133). Coronal sinus CT is the recommended examination for imaging persistent or chronic sinusitis at any age because it accurately depicts the sinus anatomy including soft tissue changes, anatomic variations, the ostiomeatal complex, and complications, especially those involving the orbit or intracranial structures (111,114,115,121, 125,153). The fourth view, the submentovertex, did not contribute to the depiction of soft tissue changes in the paranasal sinuses (133).

The second, and even more major controversial issue in imaging pediatric sinusitis, is the high incidence of soft tissue findings on plain films, CT, or MR found in patients without clinical evidence of sinus disease or undergoing these examinations for other reasons. This incidence is reported to be 33-50% (112,117,119,122,123,128,131,135,137,142). The common cold acutely produces mucosal abnormalities in sinuses including the ostiomeatal area and nasal passageways in the majority of adults (124). This incidence is even higher in infants and children and, indeed, was 97% in a study involving infants who had a cold in the two weeks preceding cranial CT done for

Table 25. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 1: Nasal discharge and fever less than 10 days duration

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain Paranasal Sinus Radiographs	2	One to four projections. See literature review.
Cranial CT including sinuses and orbits with contrast media	2	
Coronal CT scan of paranasal sinuses	2	
MR - Multiple views of paranasal sinuses with GAD	2	
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 26. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 2: Purulent nasal discharge and fever greater than 10 days duration

Radiologic Exam Procedure	Appropriateness Rating	Comments
Coronal CT scan of paranasal sinuses	8	
Plain Paranasal Sinus Radiographs	3	One to four projections.
Cranial CT including sinuses and orbits with contrast media	2	
MR - Multiple views of paranasal sinuses with GAD	2	
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 27. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 3: Headache, no nasal discharge

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain Paranasal Sinus Radiographs	2	One to four projections.
Paranasal Sinus Sonography	2	A or B mode or real time.
Cranial CT including sinuses and orbits with contrast media	2	
Coronal CT scan of paranasal sinuses	2	
MR - Multiple views of paranasal sinuses with GAD	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

other reasons (122). Soft tissue abnormalities on CT scans are dynamic and can change from day to day. Clinical correlation is critical for accurate evaluation of these findings.

MR imaging of the paranasal sinuses beautifully shows mucosal thickening, differentiates mucosal thickening from sinus secretions, and is not associated with ionizing radiation, but is not feasible as a primary imaging modality for pediatric sinusitis because of higher charges, availability, the frequent need for sedation in infants and children, and the lack of bony detail of the ostiomeatal complex felt to be a major factor in sinusitis (134). MR of the sinuses can play a role in evaluating the complications of sinusitis such as fungus involvement of the sinuses and intracranial extension as well as excluding tumor in patients with opacified sinuses (143,153). The cost of MRI in one study was competitive with plain radiographs and CT, but this is not typical (145).

Conventional tomography of the sinuses and nuclear medicine studies are rarely indicated. Control studies using ultrasound of the sinuses have shown that this modality lacks sufficient sensitivity and specificity and is not recommended (141).

Plain radiographs of the sinuses may be useful confirming soft tissue findings in patients with clinical sinusitis (121), but with very low specificity. They can be used in patients with headaches in whom the diagnosis of sinusitis is considered to be a clinical possibility. Plain radiographs of the sinuses can assist in excluding sinus disease when the clinical manifestations are unclear.

Coronal CT scans are the gold standard for diagnosing soft tissue findings in the sinuses (110, 113, 129, 139, 144, 146, 151, 152). However the high incidence of soft tissue abnormalities in the sinuses of infants and children with intercurrent or recent upper respiratory tract infections point out the need to correlate clinical and imaging findings. In addition, the incidence on CT of anatomic sinus variations, Haller cells, Concha bullosa, etc. along with the distribution of diseases within the sinuses is similar in asymptomatic infants and children as in those with recurrent sinusitis (110).

Recommendations:

1. The diagnosis of acute and chronic sinusitis should be made clinically, not on imaging findings alone.
2. When acute sinusitis is diagnosed and appropriately treated, no imaging studies are indicated if full clinical resolution occurs.
3. Patients with acute sinusitis persisting after 10 days of appropriate therapy or with chronic sinusitis, in whom imaging evaluation is desired, should undergo coronal CT scans of the sinuses regardless of the patient's age.

Table 28. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 4: Recurrent or persistent clinical sinusitis

Radiologic Exam Procedure	Appropriateness Rating	Comments
Coronal CT scan of paranasal sinuses	8	
Plain Paranasal Sinus Radiographs	2	One to four projections.
Cranial CT including sinuses and orbits with contrast media	2	
MR - Multiple views of paranasal sinuses with GAD	2	
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

4. The use of plain films in the evaluation of sinusitis should be discouraged unless exceptional circumstances warrant it. If plain radiographs are performed, Water's and Caldwell views only are recommended under age four, with a lateral view after that age. The lateral should be performed with crosstable technique if the Water's view cannot be obtained with the patient upright.

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Date for next review:2002.

HEMOPTYSIS: SUMMARY OF LITERATURE REVIEW (TABLES 33-37)

Introduction

Hemoptysis is defined as the expectoration of blood that originates from the tracheobronchial tree or pulmonary parenchyma. Life threatening hemoptysis is rare. The majority of cases are benign, self-limiting events. However, the presentation of hemoptysis may be a harbinger of significant underlying tracheo-

Table 29. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 5: Poorly responding asthma or history of atopia with persistent nasal discharge

Radiologic Exam Procedure	Appropriateness Rating	Comments
Coronal CT scan of paranasal sinuses	6	
Plain Paranasal Sinus Radiographs	2	
Cranial CT including sinuses and orbits with contrast media	2	
MR - Multiple views of paranasal sinuses with GAD	2	
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 30. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 6: Preoperative evaluation for functional endoscopic sinus surgery

Radiologic Exam Procedure	Appropriateness Rating	Comments
Coronal CT scan of paranasal sinuses	9	
Plain Paranasal Sinus Radiographs	2	One to four projections.
Cranial CT including sinuses and orbits with contrast media	2	
MR - Multiple views of paranasal sinuses with GAD	2	
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 31. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 7: Suspected complication of sinusitis, e.g., orbital cellulitis

Radiologic Exam Procedure	Appropriateness Rating	Comments
Cranial CT including sinuses and orbits with contrast media	9	
Coronal CT scan of paranasal sinuses	4	Use IV contrast material.
Plain Paranasal Sinus Radiographs	2	One to four projections.
MR - Multiple views of paranasal sinuses with GAD	2	For problem solving.
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1=Least appropriate, 9=Most appropriate

Table 32. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Possible acute or chronic sinusitis, Variant 8: Complex sinus disease, rule out fungal sinusitis

Radiologic Exam Procedure	Appropriateness Rating	Comments
Cranial CT including sinuses and orbits with contrast media	9	
MR - Multiple views of paranasal sinuses with GAD	9	
Coronal CT scan of paranasal sinus	4	Use IV contrast material.
Plain Paranasal Sinus Radiographs	2	One to four projections.
Paranasal Sinus Sonography	1	A or B mode or real time.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

pulmonary pathology. Common etiologies include: bronchitis, bronchiectasis, pneumonia, T.B., and malignancy.

Massive hemoptysis has been defined as bleeding of greater than 100-600 ml in 24 hours. The source of bleeding is usually from erosion of systemic rather than pulmonary arteries. Notable exceptions are arteriovenous malformations and pulmonary artery aneurysms. Bronchial artery embolization has been shown to be an effective therapy in the control of massive hemoptysis (154). Most authors reserve bronchial artery embolization for non-surgical candidates (155). Intervention is preceded by bronchoscopy to localize the source of bleeding. Radionuclide scanning has not been shown to supplant bronchoscopy in the setting of massive hemoptysis (156).

The imaging modalities pertinent to the evaluation of non-massive hemoptysis include chest x-ray, computed tomography and brochography. There is uniform recognition of the efficacy of chest x-ray in the initial stages of evaluation. Bronchography has been mostly replaced by C.T. in the detection of brochiectasis because it is non-invasive and competitively sensitive (157). The utilization of C.T. versus bronchoscopy and as a screening tool are controversial.

Several articles have addressed the need for further evalu-

Table 33. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Hemoptysis, Variant 1: Negative CXR, in a male with two risk factors of >40 yrs. and >40 yr. pk. hx.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-ray - Chest	9	
Nuclear Medicine-Tagged RBC's	2	
MRI - Chest	2	
Invasive - Bronchial Artery Embolization	2	
Invasive - Bronchography	2	
Nuclear Medicine - Sulfur colloid	2	
CT - Chest	No Consensus	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 34. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Hemoptysis, Variant 2: Positive CXR, in a male with two risk factors of >40 yrs. and > 40 pk. hx.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-ray - Chest	9	
CT - Chest	8	
Nuclear Medicine - Tagged RBC's	2	
Nuclear Medicine - Sulfur colloid	2	
MRI - Chest	2	
Invasive - Bronchography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 35. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Hemoptysis, Variant 3: Negative CXR, persistent/recurrent hemoptysis and/or >two risk factors (male; >40 yr; >40 yr. pk. hx.)

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-ray - Chest	9	
CT - Chest	8	
Nuclear Medicine - Tagged RBC's	2	
Nuclear Medicine - Sulfur colloid	2	
MRI - Chest	2	
Invasive - Bronchography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 36. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Hemoptysis, Variant 4: Positive CXR, persistent/recurrent hemoptysis and/or > two risk factors (male; >40 yr.; >40 yr. pk. hx.)

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-ray - Chest	9	
CT - Chest	8	
Nuclear Medicine - Tagged RBC's	2	
Nuclear Medicine - Sulfur colloid	2	
Invasive - Bronchography	2	
MRI - Chest	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

ation of patients with negative or non-localizing chest x-rays. The overall diagnostic yield in this category of patients is low. However, there is a well recognized 3-10% incidence of malignancy in this population. Authors have proposed guidelines for screening those patients that require further study. Jackson et al (158) reviewed 119 cases of hemoptysis with negative chest x-rays. He advocated that patients younger than 40 years old and negative chest x-rays could be managed with observation only. Poe et al (159) studied 196 patients with negative chest x-rays and subsequent bronchoscopy. By univariate and discriminant analysis, he found three predictors of malignancy. Risk factors were found to include: sex (male), age 50 years or older, and a greater than 40 pack year smoking history. Applying the criteria of two to three risk factors and/or bleeding in excess of 30 ml over 24 hours to his series, 100% of the cancers would have been found with an overall diagnostic yield of 82%. The utilization of bronchoscopy would have been reduced by 28%. In a subsequent study, O'Neil (160) evaluated 119 bronchoscopies performed in patients with hemoptysis and negative or non-localizing findings on chest x-ray. There was no significant difference in the rate of cancers or diagnostic yield at brochoscopy comparing patients with normal chest x-ray versus those with non-localizing findings. He recommended an initial approach of observation and reserving brochoscopy for: persistent hemoptysis, development of focal chest x-ray findings or those at risk for malignancy. He suggested Poe's risk factors with the modification of a lower age limit of 40.

There is controversy in the literature regarding the utilization of C.T. versus bronchoscopy when further study is indicated. This is compounded by the lack of a consistent clinical approach to evaluating patients with hemoptysis. The advantages of bronchoscopy include its ability to identify a specific site of bleeding, potential of therapeutic intervention and providing access for histologic sampling. Several articles, however, have sited cases of hemoptysis with negative chest x-ray and bronchoscopy in which malignancies were subsequently found by CT. (156,157,159,160,161-163). In addition, CT can establish the diagnosis of bronchiectasis. The following is a brief review of pertinent literature along with the varying conclusions:

a. Haponik (162) compared the CT findings with chest x-rays and bronchoscopy in 32 patients with respect to patient management and outcomes analysis. CT influenced the management of only six patients and did not obviate the need for bronchoscopy. He concluded that the lack of significant impact of CT on a patient management after evaluation with chest x-ray and bronchoscopy did not warrant its routine use. He did add however that CT may have a

Table 37. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Hemoptysis, Variant 5: Massive hemoptysis

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-ray - Chest	9	
CT - Chest	8	
Nuclear Medicine - Tagged RBC's	2	
Nuclear Medicine - Sulfur colloid	2	
MRI - Chest	2	
Invasive - Bronchography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1=Least appropriate, 9=Most appropriate

complementary role in selected patients having risk factors for malignancy or recurrent bleeding after non-diagnostic bronchoscopies.

b. Millar et al (157) studied 40 cases of hemoptysis with normal bronchoscopy. Abnormalities were seen on subsequent CT in 50% of patients including bronchiectasis (18%), mass (10%), alveolar consolidation (10%) and abnormal vessels (7.5%). He concluded that CT is of value in the investigation of patients with hemoptysis.

c. Set et al (163), in a prospecitve study, compared the results of CT and bronchoscopy in 91 patients with hemoptysis. CT scans demonstrated all 27 tumors identified at a bronchoscopy and 7 additional lesions, 2 of which were within bronchoscopic range. Of the bronchial carcinomas detected, most were advanced (83%) which supports the idea that hemoptysis is a late manifestation of malignancy. However, the 2 cancers that were missed by bronchoscopy were Stage 2. CT was found to be insensitive in detecting early mucosal abnormalities including squamous metaplasia and bronchitis. There were 14 cases of bronchiectasis; in all cases detected by CT alone. The conclusion was that bronchoscopy should be utilized initially when there is a strong suspicion of carcinoma. When there is a strong suspicion of malignancy and bronchoscopy and chest x-ray are negative, CT is recommended. When the suspicion of malignancy is low and chest x-ray negative, CT is suggested.

d. Naidich (156) compared the findings of bronchoscopy and CT in 58 cases. In 17 cases, CT diagnosed areas of bronchiectasis that yielded only non-specific findings on bronchoscopy. In 40% with a positive chest x-ray, CT was complementary to bronchoscopy by clarifying radiographic abnormalities and/or providing new diagnostic information. For instance, CT added additional staging information to bronchoscopy in 11 of 21 cases of non-small cell cancers. He advocated that CT may play a role in screening patients presenting with hemoptysis.

For the purpose of establishing guidelines, I would recommend the following:

1. Initial evaluation of patients with hemoptysis should include a chest x-ray.
2. Patients without two or three risk factors for malignancy (male; >40 years old; >40 pack year smoking history) and negative chest x-ray can be followed with observation.
3. Patients without two or three risk factors for malignancy and negative chest x-ray but experiencing persistent/recurrent hemoptysis should be initially evaluated with bronchoscopy. If bronchoscopy is negative, CT should be performed.
4. CT and bronchoscopy are complimentary examinations in patients presenting with two or more risk factors for malignancy and negative chest x-ray.
5. In patients with two or more risk factors and positive chest x-ray findings, CT is suggested for initial evaluation based on the following:
   a. roadmap for bronchoscopy
   b. detection of mediastinal adenopathy
   c. diagnosis other than brochogenic cancer
   d. plan for optimum diagnostic approach (bronchoscopy, percutaneous bx.,pleural bx., thoracentesis, thorascopy)
   e. staging for pts. found to have cancer
   f. baseline for post-Tx CT

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OBSTRUCTIVE VOIDING SYMPTOMS SECONDARY TO PROSTATE DISEASE: SUMMARY OF LITERATURE REVIEW (TABLES 38&39)

Introduction

Obstructive voiding symptoms secondary to prostate disease include hesitancy, decreased force of stream, terminal dribbling, post-void fullness, and double voiding (164). Benign prostatic hypertrophy (BPH) is the most common cause of prostate enlargement requiring intervention. It is estimated that by 80 years of age, 75% of men have developed BPH (1641). It has also been estimated that 10% of all males over 40 years old will have BPH requiring surgery before reaching 80 (165). Each year an estimated 400,000 men undergo TURP (164). Other causes of bladder outlet obstruction include urethral stricture,

prostate cancer, bladder neck contracture, and neurogenic disease.

Numerous imaging studies have been utilized in evaluating patients with symptoms of bladder outlet obstruction. These include plain films, intravenous urography, urethrography, both transabdominal and transrectal ultrasonography, CT, and MRI (164-182). With the coming re-engineering of health care, selective use of these modalities will be required in order to effectively decrease costs and practice efficient, effective medicine (178).

Plain film radiography cannot be used to directly visualize the prostate. A distended bladder can be visualized as a pelvic mass, but unless information is available regarding when the patient last voided, this finding is of uncertain value. Prostatic calcifications can be visualized and always indicate glandular enlargement if they extend above the pubic symphysis (181). Bladder calculi can also be easily identified. In patients with prostate cancer and bone metastases, plain films are a valuable and inexpensive diagnostic tool. Eighty percent of bone metastases are osteoblastic, and mixed osteoblastic and osteolytic lesions are seen in another 15% of patients (181). However, bone scintigraphy is far more sensitive in identifying bone metastases at an early stage (181).

The routine use of intravenous urography (IVP) is not recommended (166,173,174,178,180-182). In patients who have stones on plain films hematuria, or an atypical history, however, IVP may be warranted (180-181). There is no evidence that patients with BPH have a higher incidence of asymptomatic renal cancers than the general population in the same age group; therefore, an IVP to search for occult neoplasms is unwarranted (166). In a prospective study of 502 patients, Wasserman found benign renal cysts in 10%, renal cancers in less than 1%, and significant upper urinary tract obstruction in 2.6% (182). When patients have obstructive symptoms and renal insufficiency, ultrasound rather than IVP is recommended to evaluate for hydronephrosis (181). In patients with severe hydronephrosis, azotemia is almost always present and ultrasound is indicated.

Retrograde urethrography is valuable to exclude urethral strictures but does not accurately assess the size of the prostate gland. As such, it is not part of the routine evaluation of patients with prostatism (181). Voiding cystourethrography should be considered only in those cases of men younger than 50 with outflow obstruction symptoms (181).

Sonography can be used to evaluate the prostate transabdominally (through a distended bladder) or transrectally (TRUS). The ultrasound pattern is still too nonspecific to differentiate benign from malignant prostate lesions. It has been suggested that ultrasound contrast agents will make the appearance more sensitive and better direct the biopsies to achieve a higher positive yield. Secondary changes of bladder outlet obstruction, such as bladder wall thickening, are better seen with ultrasound than IVP (167). Since the size of the enlarged prostate can be detected accurately by suprapubic (or transabdominal) ultrasound, TRUS is frequently unnecessary (167,175). Identifying the size of the prostate is important since it helps determine the type of therapy indicated. One of the complications of TURP, water overload, is thought to be the result of excessive operating time due to the gland size. In very large glands, which can be measured with ultrasound preoperatively,

Table 38. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Obstructive Voiding Symptoms Secondary to Prostate Disease, Variant 1: Normal Renal Function

Radiologic Exam Procedure	Appropriateness Rating	Comments
Transabdominal Ultrasound of the Bladder	5	Post void to measure residual urine. If significant residual, then evaluation of upper tracts is indicated. Gives estimate of prostate size.
Transabdominal Ultrasound of the Kidney	3	Appropriateness rating could be greater if significant residual urine were present. Evaluate for hydronephrosis.
IVP	3	Appropriateness rating could be greater if significant residual urine present. In patients with stones, hematuria, or atypical history, the study may be warranted.
Supine Abdomen	2	Other imaging studies more useful.
Retrograde Urethrogram	2	Does not assess prostate size.
TRUS	2	Transabdominal ultrasound can assess prostate size.
VCUG	2	Consider in men younger than 50 with symptoms.
MRI of Pelvis	2	Costly.
CT of Abdomen/Pelvis	1	Not indicated.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 39. ACR APPROPRIATENESS CRITERIA™ - Clinical Condition: Obstructive Voiding Symptoms Secondary to Prostate Disease, Variant 2: Increased BUN and/or Cr.*

Radiologic Exam Procedure	Appropriateness Rating	Comments
Transabdominal Ultrasound of the Bladder	8	To evaluate for residual urine and prostate size.
Transabdominal Ultrasound of the Kidney	8	To evaluate for hydronephrosis.
Supine Abdomen	3	To exclude calculi. Can be used in association with ultrasound.
IVP	2	Other studies better used to evaluate same structures.
Retrograde Urethrogram	2	Does not assess prostate size.
TRUS	2	Can assess prostate size by transabdominal ultrasound.
VCUG	2	Consider in men younger than 50 with symptoms.
MRI of Pelvis	2	Costly.
CT of Abdomen/Pelvis	1	Not indicated.

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

* Refer to appropriateness criteria for renal failure as well. For example, in patients who have elevated renal function tests even after catheter drainage, renal scintigraphy should be considered.

an open procedure may be preferred. Abdominal (suprapubic) ultrasound may also be used to accurately (plus or minus 15%) measure residual urine volume in 90% of patients (169,172). However, catheterization is probably the least expensive method to accurately assess residual urine in the bladder. In patients with azotemia, the collecting system of the kidneys should be imaged for dilatation. In patients with normal renal function, this may not be necessary. However, in a study of 128 patients, Lacey reported that hydronephrosis can be present with normal biochemical results (173). The Clinical Practice Guideline of the Agency for Health Care Policy and Research (AHCPR) states that imaging of the upper urinary tracts by US or IVP is "not recommended unless patients have one or more of the following: hematuria, urinary tract infection, renal insufficiency, history of urolithiasis or history of urinary tract surgery" (183).

CT has not proven to be of much value in evaluating the benign, enlarged prostate (179). There are reports of the value of MRI in evaluating the prostate gland (171,177). MRI is also useful in evaluating prostate size, although other less costly procedures, such as ultrasound, are preferred.

In summary, in patients who have normal renal function but suffer the symptoms of prostatism, a radiographic workup should be minimal. Ultrasound is occasionally desirable for estimating prostate size prior to surgery. If azotemia is present, the upper urinary tracts should definitely be evaluated for the presence of hydronephrosis with ultrasound.

Approved date: September 1998.
Date for next review: September 2001

ENDOMETRIAL CANCER OF THE UTERUS: SUMMARY OF LITERATURE REVIEW (TABLES 40-45)

Introduction

Cross-sectional imaging in the pretreatment evaluation of gynecologic cancer patients can play an important role. In cancer of the uterus, cross-sectional imaging offers an assessment of morphologic prognostic factors including tumor size, depth of penetration, stage of disease, and lymph node status. Imaging should be looked upon as a complementary tool rather than competitive with the other methods of tumor evaluation (e.g., clinical or surgical assessment).

Endometrial Cancer

Clinical Background and Prognostic Factors

Endometrial carcinoma is the fourth most common cancer in females and the leading invasive malignancy in the female genital tract. It accounts for approximately 34,900 new cases diagnosed with an estimate of 6,000 deaths (184). Endometrial cancer primarily presents at stage I (80% of cases), and the recommended treatment is total abdominal hysterectomy and bilateral salpingo-oophorectomy. Depending on prognostic factors such as depth of invasion and tumor grade, lymphadenectomy may also be indicated. The major diagnostic factors necessary for the preoperative evaluation of endometrial cancer are:

1. determination of the risk of lymph node metastasis in order to have skilled surgical consultation available.
2. diagnosing gross cervical invasion which requires preoperative radiation therapy or a different treatment plan i.e. radical hysterectomy instead of total abdominal hysterectomy
3. detection of advanced disease

The most important prognostic variables for carcinoma of the uterus are the histologic grade and the stage of tumor (Table 45) including depth of myometrial invasion and lymph node metastasis (185,186) In a study of 1,566 patients with adenocarcinoma of the uterus the depth of myometrial invasion was found to be the single most important prognostic factor. In stage IA and IB disease, when the tumor is confined to the endometrium or to the superficial myometrium, the incidence of para-aortic lymph node metastases is only 3%. Conversely, in stage IC disease, when there is deep myometrial invasion, lymph node metastases occur in 6-46% (185,187). Clinical FIGO staging is not accurate to assess the depth of myometrial invasion or the presence of lymphadenopathy. As clinical staging carries an overall error in understaging of about 13-22%, routine surgical staging has been recommended by the Federation Internationale de Gynecologie et Obstetrique (FIGO) since 1988 (186). Preoperative evaluation of prognostic factors helps in subspecialist treatment planning. In this setting, the role of imaging is to depict noninvasively deep myometrial invasion, the presence of lymphadenopathy, and to stage the tumor extent before treatment planning. Diagnostic imaging may also be helpful in primarily obese, elderly population where radiation therapy rather than surgery might be advocated as a primary treatment or as a preoperative adjuvant to surgery.

Use of Imaging in Clinical Guidelines

Transabdominal ultrasonography is considered unreliable in staging endometrial cancer. The use of endovaginal sonography has shown promise in the evaluation of myometrial invasion. Reported accuracies for myometrial invasion in stage I range from 69-85% in differentiating deep invasion (IC) from absent or superficial invasion (IA- IB) (188-191), and from 68-69% in differentiating stage IA versus IB and versus IC (192,193). The limitations of ultrasound appear to be in limited suboptimal soft tissue contrast resolution (the tumor and the adjacent myometrium often have similar echogenicity), relatively small field of view precluding assessment of large tumors, and patient physique (patients with endometrial carcinoma are often obese and have short stature). False positive results of myometrial invasion are due to polypoid tumors, pyometra, myomas or focal adenomyosis mimicking myometrial invasion and myometrial atrophia (193). False negative results occur in case of superficial growth or microinvasion (193). In addition, there are insufficient reports about the value of endovaginal sonography in predicting cervical extension, parametrial invasion or lymphadenopathy.

Table 40. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Endometrial Cancer of the Uterus, Variant 1: Newly diagnosed endometrial cancer – diagnostic work-up

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI		
Pelvis	8	
Abdomen	4	
Chest X-ray	6	
CT		
Abdomen	4	
Pelvis	4	
Ultrasound	4	
IVP	2	
Barium Enema	2	
Lymphangiography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 41. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Endometrial Cancer of the Uterus, Variant 2: Assessing the depth of myometrial invasion

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI		
Contrast enhanced	9	
No contrast	6	
CT	6	
Endovaginal Ultrasound	6	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 42. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Endometrial Cancer of the Uterus, Variant 3: Overall staging

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI		
Contrast enhanced	8	Contrast significantly improves evaluation.
No contrast	6	
CT	4	
Endovaginal Ultrasound	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 43. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Endometrial Cancer of the Uterus, Variant 4: Lymph node evaluation

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT	8	Either CT or MRI appropriate.
MRI	8	Either CT or MRI appropriate.
Ultrasound	2	
Lymphangiography	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 44. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Endometrial Cancer of the Uterus, Variant 5: Assessing endocervical tumor extent

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI	8	
CT	4	
Endovaginal Ultrasound	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1=Least appropriate, 9=Most appropriate

CT has been used for the evaluation of endometrial carcinoma with emphasis on the evaluation of the depth of myometrial invasion and assessment of lymph node status. In studies comparing CT to ultrasound or MRI, the accuracy of CT for myometrial invasion is reported to be from 58-61% versus 68-69% in ultrasound and 88-89% in MRI (188,191). One study found no significant difference between CT and ultrasound for the diagnosis of deep myometrial invasion (188). The value of CT in diagnosing cervical extension is not evident, as an easy identification of the limit between the cervix and the uterine corpus is difficult on axial imaging planes. Moreover, most reports suffer from a low number of patients with stage II, which may prevent valid conclusions to be drawn.

Reports in the literature show superiority of MRI when compared with ultrasound in both the evaluation of tumor extension into the cervix and myometrial invasion (188,192,193). The difference is statistically significant (194). The meta-analysis study shows that in the evaluation of the depths of myometrial invasion in a patient with endometrial cancer, the efficacy of contrast enhanced MRI is significantly better than ultrasound, CT, or non-contrast MRI. When MRI is used for the evaluation of the depths of myometrial invasion, contrast enhanced MRI performs significantly better (194). The superiority of MRI over CT and clinical staging has also been documented (188,191). It is generally agreed that, at present, MRI provides the most accurate and consistent evaluation of patients with endometrial cancer. The overall staging accuracy of MRI has been reported to be between 85% and 92% (188,191,193,195,196). The efficacy of MRI is improved with the use of dynamic contrast-enhanced imaging. The assessment of the depth of myometrial invasion shows significant improvement with the use of dynamic scanning (accuracy of 55%-77% for noncontrast images versus 85%-91% for contrast-enhanced images (197-199). Compared with T2-weighted images, the use of contrast media will reduce both overestimation as well as underestimation of depth of myometrial invasion.

Table 45. Revised Surgical FIGO Staging of Endometrial Carcinoma (186)

Stage	Definition
0	Carcinoma in situ.
I	Tumor confined to corpus.
	IA: tumor limited to endometrium
	IB: invasion greater than 50% of myometrium
	IC: invasion smaller than 50% of myometrium
II	Tumor invades cervix but does not extend beyond uterus
	IIA: invasion of endocervix
	IIB: cervical stromal invasion
III	Tumor extends beyond uterus but not outside pelvis
	IIIA: invasion of serosa, adnexa, or positive peritoneal cytology
	IIIB: invasion of vagina
	IIIC: pelvic and/or para-aortic lymphadenopathy
IV	Tumor extends outside the pelvis but or invades bladder or rectal mucosa
	IVA: invasion of bladder or rectal mucosa
	IVB: distant metastasis (includes intra-abdominal or inguinal lymphadenopathy)

The erroneous MRI assessment of the depth of myometrial invasion can sometimes be ascribed to as large polypoid endometrial cancer which distends the uterus so that the thin rim of myometrium is stretched over it rather than being deeply infiltrated (193,200).

Cervical extension can be diagnosed reliably with an accuracy ranging from 86%-95% (201,202). One study comparing MR imaging to fractional curettage and hysteroscopy showed that MR imaging had the highest sensitivity (91%) and specificity (96%) for the diagnosis of cervical involvement in endometrial cancer (202).

In the evaluation of lymph node metastases, compared to either CT or MRI, ultrasound has a significantly lower sensitivity for the detection of pelvic lymph node metastases. The efficacy of CT and MRI in the evaluation of lymph node metastases is similar, and both modalities rely on anatomic findings of nodal size, (equal or greater than 1 cm on short axis). Lymphography is not recommended for the evaluation of cancer of the endometrium. Not only is the modality invasive, and very few imaging centers offer this service, its performance, because of the difficulties in the evaluation of pelvic nodes, is slightly inferior, and not statistically significant to that of CT and MRI.

Recommended Imaging Approach

Ultrasound, especially with the use of endovaginal sonography, is sometimes considered to be the primary imaging approach. However, in patients in whom ultrasound is suboptimal or in whom the results of imaging studies will directly influence the choice of therapy and guide in therapy planning, the higher accuracy of contrast-enhanced MR imaging warrants its use. In patients presenting with a large endometrial tumor MR imaging should be preferred to CT and should represent the primary imaging technique. If cervical involvement is the major clinical concern, MRI is the study of choice. However, there are no outcome studies or cost-effectiveness on imaging evaluation of endometrial cancer. The views expressed in this summary are a combination of literature review and expert opinion.

Conclusion

Patients with endometrial carcinoma should undergo cross-sectional imaging only in cases of clinical staging difficulties, including obese patients, patients with large tumors, poor histologic tumor grade or possible cervical involvement. If imaging is needed, MRI is the most accurate technique and should be the primary imaging modality.

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Date for next review: 2002.

NON-SMALL CELL LUNG CARCINOMA, NONSURGICAL AGGRESSIVE THERAPY: SUMMARY OF LITERATURE REVIEW (TABLES 46-53)

Introduction

In 1986, the American Joint Committee on Cancer and the Union Internationale Contre le Cancer divided Stage III non-small cell cancer of the lung (NSCLC) into Stage IIIA and Stage IIIB. Stage IIIA defines patients with limited, localized extrapulmonary extension of the tumor and metastasis limited to the ipsilateral mediastinal and subcarinal lymph nodes. T1-3N2 or T3N0-1M0 are in this category. Stage IIIA patients can be resected with possibly some advantage to receive neoadjuvant chemotherapy (203,204). Some of the patients with Stage II and IIIA but having poor lung function and/or other medically inoperable conditions will have aggressive radiation therapy with or without chemotherapy. Stage IIIB includes patients with more extensive tumor invading the mediastinum (T4) and/or metastasis to the contralateral mediastinal, contralateral hila and ipsilateral or contralateral supraclavicular (N3). They are considered to be surgically unresectable and are usually treated by radiation therapy alone, combined radiation therapy and chemotherapy and occasionally by chemotherapy alone for more palliative purposes.

Radiation therapy used to be considered a standard treatment for patients with unresectable and locally advanced NSCLC. RTOG 73-01 (205) tried to optimize time/dose scheduling for these patients showing that the best local control and 2-year survival were achieved by a total dose of 60.0 Gy in 6 weeks. The investigators randomized 375 patients with inoperable or unresectable Stage III to be treated by 4 Gy/day X 5 days/week with a 2-week break and repeated 4 Gy/day X 5 days/week giving a total dose of 40 Gy in 6 weeks (split course),

or 40 Gy in 4 weeks, 50 Gy in 5 weeks or 60 Gy in 6 weeks with continuous treatment. The overall complete and partial regression rates were 46% among the patients who received 40 Gy split course, 51% with 40 Gy continuous course, 65% with 50 Gy and 61% with 60 Gy. The difference in the response rates was statistically significant (49% vs. 63%, P=0.0005) between the groups who received 40 Gy and 50-60 Gy. Two-year survival rates were 14% among the patients who received 40 Gy continuous course and 18% for the patients who received 50-60 Gy compared to only 10% among the patients who received split course, although this difference was not statistically significant. Patients treated with 50 to 60 Gy with tumor control had 22% in 3 years compared with 10% if patients failed in the thorax (P=0.005). The initial response rate was significantly better among the patients with adenocarcinoma and large cell carcinoma (69%) compared to those with squamous cell carcinoma (50%) (P=0.001).

Because of the poor two-year survival and local control, a dose escalation study was initiated through RTOG 83-11. To increase local control by higher total dose without increasing toxicities of late responding normal tissue, a twice daily fractionation regimen was applied by a randomized dose-escalation study (206). Eight hundred and forty patients were randomized to receive 1.2 Gy twice daily fractionation separated by 4-6 hours. They were randomized to receive minimal total doses of 60 Gy, 64.8 Gy and 69.6 Gy. After acceptable acute toxicities, 74.4 Gy and 79.2 Gy arms were added. The best arm was 69.6 Gy in 6-1/2 weeks showing a 2-year survival of 29% for pa-

Table 46. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 1:T1N3M0: 55 year old female with a palpable supraclavicular lymph node. FNA showed poorly differentiated adenocarcinoma. CXR showed 2 cm nodule in RLL. KPS > 70, weight loss < 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Plus Chemotherapy	8	
Radiation Therapy Alone	3	Standard treatment for patients. Good performance status and no weight loss is combined chemotherapy and radiotherapy.
Chemotherapy Alone	2	
Surgery	2	
Timing of Chemotherapy with RT-If Given		
Neoadjuvant	8	
Neoadjuvant plus concurrent	6	RTOG 88-04 (VB+DDP x 2 cycles followed by XRT+DDP) showed 35% survival.
Concurrent	6	EORTC showed concurrent chemotherapy improved survival compared to RT alone without significantly increased toxicities.
Post RT	2	
Local Irradiation		
60 Gy/6 weeks	8	
64.8 Gy/7 weeks	8	
70 Gy/7 weeks	4	
69.9 Gy/6 1/2 weeks (bid)	3	RTOG 83-11 showed improved survival compared to 60Gy (1.2Gy bid).
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	RT alone could be well tolerated compared to concurrent chemotherapy and RT.
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
Multifield technique	8	
AP/PA only	2	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

tients with good performance status and <5% weight loss, which was significantly better compared to the survival among the patients who received lower doses (P=0.02).

Cancer and Leukemia Group B (CALGB) (207) randomized 155 patients with Stage III NSCLC with good performance status and <5% weight loss who were treated with 2 cycles of Vinblastine and Cisplatin followed by radiation therapy (60 Gy in 6 weeks) or radiation therapy alone (60 Gy in 6 weeks). Patients who were treated by induction chemotherapy followed by radiation therapy had a median survival of 13.8 months (78 patients) compared to 9.7 months (77 patients) treated by radiation therapy alone. Two-year survival was significantly better among the patients who received combined treatment compared to those who received radiation therapy alone, 26% vs. 13% (P=0.006). The longer follow-up of this study (208) confirmed that 5-year survival of patients who received combined treatment was 19% compared to 7% of those who received radiation therapy alone.

Le Chevalier and Arriagada et al (209) also reported a Phase III randomized study comparing radiation therapy alone to combined chemotherapy showing a significant improvement in three-year survival by combined treatment, 12% vs. 4% (P=0.02), and median survivals were 12 months and 10 months, respectively.

The RTOG 88-08 (210) randomized 452 patients with Stage III NSCLC good performance status and <5% weight loss to be treated in 3 arms. Arm 1 combined chemotherapy, Vinblastine and Cisplatin for 2 cycles, followed by radiation therapy, 60 Gy in 6-1/2 weeks. The other 2 arms were radiation therapy alone, giving 60 Gy in 6 weeks, or 69.6 Gy hyperfractionated (HFX) radiation therapy with fraction size of 1.2 Gy. The median survival was 13.8 months compared to 11.4 months among the patients who received HFX radiation therapy. Two-year survival was 32% among the patients who received combined treatment vs. 19% among the patients who received HFX radiation therapy (P=0.003).

There are other Phase III trials which have been reported

Table 47. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 2:T2N3M0: 60 year old male with hoarseness due to paralyzed left vocal cord. Chest CT revealed APW node enlargement and 5 cm mass in RML. FNA showed undifferentiated large cell carcinoma. KPS > 70, weight loss < 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Plus Chemotherapy	8	
Radiation Therapy Alone	3	Standard treatment is induction chemotherapy followed by RT.
Surgery	2	
Chemotherapy Alone	2	
Timing of Chemotherapy with RT-If Given		
Neoadjuvant	8	
Neoadjuvant plus concurrent	6	RTOG 88-04 Phase II study showed 2 year survival 35%.
Concurrent	6	EORTC showed improved survival.
Post RT	2	
Local Irradiation		
60 Gy/6 weeks	8	
64.8 Gy/7 weeks	8	
70 Gy/7 weeks	4	
69.9 Gy/6 1/2 weeks (bid)	3	RTOG 83-11 showed improved survival compared to 60Gy (1.2Gy bid).
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	RT alone could be well tolerated compared to concurrent chemotherapy and RT.
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
Multifield technique	8	
AP/PA only	2	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 48. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 3: T3N3M0: 60 year old male with post obstructive pneumonia due to endobronchial lesion at the left mainstem. Biopsy revealed SCC. Chest CT showed right paratracheal adenopathy. KPS ≥ 70, weight loss ≤ 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Alone	8	
Radiation Therapy Plus Chemotherapy	5	
Chemotherapy Alone	2	
Surgery	2	
Timing of Chemotherapy with RT-If Given		
Concurrent	6	
Neoadjuvant	2	
Post RT	2	
Local Irradiation		
70 Gy/7 weeks	8	
64.8 Gy/7 weeks	8	
69.9 Gy/6 1/2 weeks (bid)	6	RTOG 88-08 showed almost equivalent 3 year survival between neoadjuvant chemotherapy followed by daily RT (60 Gy) and bid RT (69.6 Gy)
60 Gy/6 weeks	5	
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
Multifield technique	8	
AP/PA only	2	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

since 1988, including an EORTC study (211) with a daily Cisplatin and simultaneous radiation therapy arm showing an improved significant 2-year survival, 26% compared to 13% among the patients who received radiation therapy alone (P=0.009). However, the irradiation therapy schedule was not considered optimal as a standard of radiation therapy in the U.S. The control arm of radiation therapy was given by 3 Gy times 10 fractions with a 3 to 4 week break followed by 2.5 Gy times 10 fractions as a boost. Wolf et al (212) also showed an improved median and a 2-year survival by combined treatment compared to radiotherapy alone, 13.7 months vs. 9.0 months and 24% vs. 12%, respectively.

However, other Phase III trials have not found any significant improvement by adding chemotherapy to radiotherapy (213-217). Trovo et al (213) reported Cisplatin given concurrently with radiation therapy 45 Gy in 3 weeks (3 Gy/day X 5 days/week) vs radiation therapy alone (45 Gy in 3 weeks) did not show any significant difference in local control and survival. Morton et al (214) randomized 121 patients to radiation therapy alone vs Cyclophosphamide, Doxorubicin and Cisplatin as induction chemotherapy followed by radiation therapy which did not show any significant improvement in the median survival. Mattson et al (215) randomized 238 patients to radiation therapy alone vs chemotherapy (CAP regimen) followed by radiation therapy and did not show any significant difference in the median survival.

RTOG 91-06 has combined the best arm of 83-11 (a toal dose of 69.6 Gy) with concurrent VP-16 and Cisplatin , which revealed a 2-year survival of 40% and a median survival of 19.7 months among the patients with good performance status and <5% weight loss among 76 with unresectable NSCLC (218).

Jeremic et al (219) randomized 169 patients with Stage III NSCLC to investigate maximal tolerance dose of chemotherapy combined with HFX radiation therapy. Chemotherapy was given concurrently with HFX radiation therapy of 64.8 Gy with Carboplatin and Etoposide. Arm 1 of treatment was HFX radia-

Table 49. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 4:T4N0M0: 60 year old male with left shoulder pain radiating to the ulnar distribution of his left upper extremity accompanied with Horner syndrome. MRI of chest revealed left SST involving into C7 and T1 vertebral bodies, left posterior 1st and 2nd ribs. Tumor was close to foramen between C7 and T1. FNA of left SST showed poorly differentiated adenocarcinoma. KPS ≥ 70, weight loss ≤ 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Plus Chemotherapy	8	
Radiation Therapy Alone	7	
Chemotherapy Alone	2	
Surgery	2	
Timing of Chemotherapy with RT-If Given		
Concurrent	8	
Neoadjuvant	2	Because of pain control and prevention of cord compression concurrent chemotherapy is recommended rather than neoadjuvant chemotherapy.
Neoadjuvant plus concurrent	2	Because of pain control and prevention of cord compression concurrent chemotherapy is recommended rather than neoadjuvant chemotherapy.
Post RT	2	
Local Irradiation		
60 Gy/6 weeks	8	
70 Gy/7 weeks	8	
64.8 Gy/7 weeks	8	
69.9 Gy/6 1/2 weeks (bid)	7	
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
Multifield technique	9	
AP/PA only	2	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	6	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

tion therapy alone with a total dose of 64.8 Gy given to 61 patients. Arm 2 was HFX radiation therapy to the same total dose with chemotherapy consisting of 100 mg of Carboplatin, days 1 & 2, and 100 mg Etoposide, days 1-3, given every week during radiation therapy to 52 patients. Arm 3 was HFX radiation therapy to the same tumor dose with 200 mg Carboplatin days 1 & 2 and 100 mg of VP-16 days 1-5 during the, 1st, 3rd and 5th weeks of radiation therapy given to 56 patients. Acute and late toxicities were scored according to the RTOG scoring system. They concluded that this study showed the addition of chemotherapy to HFX radiation therapy carried a risk of increased high-grade toxic effects both acute and late.

At the present time, combined treatment appears to be better in terms of median and 2-year survival compared to radiation therapy alone for patients with medically inoperable and surgically unresectable Stage IIA and B NSCLC. However, sequences of chemotherapy and radiation therapy are still under investigation (RTOG 92-04, 94-10). Also, HFX radiation therapy (1.2 Gy/fraction, BID) vs daily fractionation were not compared in terms of efficacy and toxicity when it was combined with concurrent chemotherapy for NSCLC. The standard treatment at the present time is 2 cycles of chemotherapy, usually Cisplatin-containing regimen with Vinblastine or VP-16 2 cycles followed by standard radiation therapy, 60 Gy in 6 weeks.

Approved date: 1996.
Date for next review: 1999

Table 50. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 5:T4N1M0: 60 year old male with a few weeks history of superior vena caval obstruction (SVCO). Bronchoscopy revealed extrinsic compression of RUL. FNA showed undifferentiated large cell carcinoma. Chest CT showed 6 cm mass in RUL invading directly to mediastinum with compression of SVC and right hilar enlargement. KPS ≥ 70, weight loss ≤ 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Alone	8	
Radiation Therapy Plus Chemotherapy	8	
Chemotherapy Alone	2	
Surgery	2	
Timing of Chemotherapy with RT-If Given		Any patients with acute symptoms caused by NSCLC such as severe pain, pending cord compression, post-obstructive pneumonia, SVCO and severe hemoptysis, require urgent loco-regional RT with or without concurrent chemotherapy depending on degree of their hematologic reservation. Nedoadjuvant chemotherapy is not recommended until the acute symptoms will be resolved.
Concurrent	8	
Neoadjuvant	2	
Neoadjuvant plus concurrent	2	
Post RT	2	
Local Irradiation		
60 Gy/6 weeks	8	
70 Gy/7 weeks	8	
64.8 Gy/7 weeks	8	
69.9 Gy/6 1/2 weeks (bid)	7	
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
Multifield technique	9	
AP/PA only	2	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	6	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 51. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 6:T4N2M0: 63 year old male with hemoptysis and chest pain. Bronchoscopy revealed ulcerating carinal lesion. Biopsy showed SCC. Chest CT showed subcarinal lymph node enlargement. KPS > 70, weight loss < 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Alone	8	
Radiation Therapy Plus Chemotherapy	8	
Chemotherapy Alone	2	
Surgery	2	
Timing of Chemotherapy with RT-If Given		
Concurrent	8	
Neoadjuvant	2	Neoadjuvant chemotherapy is depending on the amount of hemoptysis. Small amount of hemoptysis will allow neoadjuvant chemotherapy.
Neoadjuvant plus concurrent	2	Neoadjuvant chemotherapy is depending on the amount of hemoptysis. Small amount of hemoptysis will allow neoadjuvant chemotherapy.
Post RT	2	
Local Irradiation		
60 Gy/6 weeks	8	
70 Gy/7 weeks	8	
64.8 Gy/7 weeks	8	
69.9 Gy/6 1/2 weeks (bid)	7	
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
Multifield technique	9	
AP/PA only	2	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	4	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 52. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 7: T4N3M0: 58 year old female with a palpable right supraclavicular lymph node. Biopsy showed poorly differentiated SCC. Chest CT showed a small amount of right pleural effusion which is too small to be tapped. KPS ≥ 70, weight loss ≤ 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Alone	5	
Chemotherapy Alone	5	
Radiation Therapy Plus Chemotherapy	2	If the pleural effusion is positive, they will be treated palliatively. If the pleural effusion is negative for malignancy or too small to be tapped, they should be treated as Variant 1.
Surgery	2	
Timing of Chemotherapy with RT-If Given		
Neoadjuvant	2	
Neoadjuvant plus concurrent	2	
Concurrent	2	
Post RT	2	
Local Irradiation		
30 Gy/2 weeks	8	
45 Gy/3 weeks	8	
40 Gy/4 weeks	8	
64.8 Gy/7 weeks	8	
50 Gy/5 weeks	5	
60 Gy/6 weeks	2	
70 Gy/7 weeks	2	
64.8 Gy/6 weeks (bid)	2	
69.9 Gy/6 1/2 weeks (bid)	2	
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
AP/PA only	7	
Multifield technique	7	
For Local Irradiation		
Complex blocking	8	
Computer planning	5	
CT-Based planning	5	
3D Treatment planning	2	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

Table 53. ACR APPROPRIATENESS CRITERIA™ - Clinical condition: Nonsurgical, Aggressive Therapy for NSCLC, Variant 8:T1N0M0: 70 year old male with long history of heavy smoking and COPD with previous history of cancer of larynx 5 years ago. Routine CXR showed nodule of LLL. FNA showed SCC. Medically inoperable due to COPD. KPS ≥ 70, weight loss ≤ 5%.

Treatment	Appropriateness Rating	Comments
Radiation Therapy Alone	8	
Radiation Therapy Plus Chemotherapy	2	
Chemotherapy Alone	2	
Surgery	1	
Timing of Chemotherapy with RT-If Given		
Neoadjuvant	2	
Neoadjuvant plus concurrent	2	
Concurrent	2	
Post RT	2	
Local Irradiation		
70 Gy/7 weeks	8	
64.8 Gy/7 weeks	8	
69.9 Gy/6 1/2 weeks (bid)	6	
60 Gy/6 weeks	5	
30 Gy/2 weeks	2	
45 Gy/3 weeks	2	
40 Gy/4 weeks	2	
50 Gy/5 weeks	2	
64.8 Gy/6 weeks (bid)	2	
55 Gy/7-8 weeks (split course)	2	
Radiotherapy Technique		
AP/PA only	8	
Multifield technique	8	
For Local Irradiation		
Computer planning	8	
CT-Based planning	8	
Complex blocking	8	
3D Treatment planning	5	

Appropriateness Criteria Scale: 1 2 3 4 5 6 7 8 9, 1 = Least appropriate, 9 = Most appropriate

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