Incorporation of the ACR Appropriateness Criteria into Medical Student Clerkship

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What is the ACR Appropriateness Criteria (ACC)?

- Guidelines of which imaging tests to order for a particular symptom or diagnostic challenge
- Based on research studies outlining the sensitivity and specificity of each imaging modality
- Incorporates the MOST common diagnoses based on the clinical symptom
- Takes into account cost and radiation risk
- Guide to non-radiologists to promote appropriate imaging in the most commonly encountered clinical situations

AAC Use in Medical Practice

- ACR Appropriateness Criteria are often not widely accepted into practice
  - Major reasons for lack of adoption:
    - Most common cause - Lack of knowledge of existence of the guidelines
    - Second most common cause – Lack of understanding of how to use the guidelines

- Studies looking at medical student perceptions about the AAC showed that the majority of students planned to use the resources once they were educated about it.
  - Fewer than 50% of students were able to correctly answer questions about appropriate imaging and radiation and contrast risks of imaging

AAC Use in Medical Practice

- Studies have shown many statistics about the quality of radiology education among medical students and internal medicine interns. Interns are frequently asked to interpret and order imaging during their rotations.
  - 93.4% reported that the ability to read chest x-rays was very important
  - 12.6% of interns receive no formal radiology training at all
  - 81% of interns have no direct experience with the ACR Appropriateness Criteria

- Only 33.1% report high confidence in knowing whether to order a study with or without contrast

Saha et al, 2013.
AAC Use in Medical Practice

- A retrospective review of imaging studies using radiation in an Emergency Room setting showed that implementation of the AAC on those studies would have:
  - Reduced imaging costs to the patient by 39%
  - Reduced radiation doses by 44%

- It is imperative that medical students are trained in the use of AAC in clinical practice so that they can improve care, reduce costs and risks, and order appropriate imaging as interns, residents, and attendings.
  - This teaching is also highly desired by medical students rotating through radiology clerkships.

Hadley et.al 2006.
Reasons medical students enroll in radiology electives

- Learning Appropriate Imaging, 75
- Understanding how to read basic imaging (xrays, CT), 5
- Getting exposure to interventional radiology, 3
- Career planning, deciding on a field, 7
- Learning Emergency Findings, 10

Total students interviewed - 46

Percentages, based on a survey from our institution to rotating medical students
Implementing AAC into a clerkship

To be effective, an AAC based curriculum must do the following:

- Educate students about the goals of the AAC
- Provide students access to the AAC in a quick and easy to read format
- Create interactive and memorable examples of how to implement the guidelines
- Provide education about the types of imaging studies and how they differ
- Provide education about contrast and radiation safety
After Implementation of these Changes

- Prior to changing the curriculum we conducted a survey to assess student needs. Surveys were conducted after the students had already finished the clerkship.
- Initial surveys asked (total – 25 students):
  - Medical student interest in radiology
  - Goals of the clerkship
  - Preferred learning styles (open-ended question)
- Surveys showed:
  - Students wanted more dedicated lecture time for medical students and felt this was more valuable than resident conferences
  - Students want lecture or reading materials that are geared toward their level of knowledge
  - Medical students wanted to reduce reading room time
  - Ideal teaching style was small group case-based learning
  - Medical student interest in pursuing radiology was low (3 out of 25)
Based on these surveys, we used multiple teaching techniques to incorporate ACC into various aspects of our clerkship curriculum.

Step 1: Incorporation of a textbook
Step 2: Didactic sessions
Step 3: Student-led case presentations
Step 4: Group discussions
Step 5: Reading room involvement
Step 1: Incorporation of a Textbook

- Through the use of the *Learning Radiology: Recognizing the Basics* textbook (by William Herring, published by Elsevier).

- Textbook allows us to introduce the concepts of imaging to students before the clerkship.

- Students have assigned reading that involves descriptions of what the various modalities are, which ones involve radiation, which ones involve contrast, and what they are commonly used for.

Step 1: Incorporation of a Textbook

- Students are assigned weekly readings throughout the 2 or 4 week rotation.
- Textbook provides students with a solid foundation which is built upon during the entire rotation.
- There are bi-weekly quizzes from the reading, with an entire section of the quiz focused on appropriate imaging. Quizzes are open-book and students can consult the ACR website to utilize the AAC.

Step 1: Incorporation of a Textbook

- Advantages of the textbook:
  - Students can hit the ground running when they start the clerkship – more time can be spent on more advanced topics
  - Students can review topics throughout the clerkship to reinforce topics they experience
  - Topics can be taught on the students’ time
Faculty and resident led lectures are presented to the students to describe what the AAC is, show students how to access the guidelines on the ACR website, and how to read the documents and guidelines from the website.

**Benefits:**
- Can be standardized to make sure all students receive the same training
- Can be prepared ahead of time and repeated every month
- Easy to distribute to all students
- Easier to produce
We conducted a pre-lecture quiz to assess student knowledge with AAC:
- Total of 21 questions, 20 of which presented cases to assess appropriate imaging.

Sample questions:
- “Do you know about the AAC?”
- “A 28 year old woman presents with focal breast pain, what is the next step in diagnosis?”

Pre-lecture quiz scores (total 46 students):
- 96% of students did not know about the AAC prior to the rotation.
- 78% could not answer the appropriate imaging study in at least 5 of the questions.
- 55% did not correctly answer at least 15 of the 20 questions.
Step 2: Didactic lectures on AAC

- After discussing the guidelines directly from the ACR website:
  - 100% of students understood what the AAC was and where to look for it online
  - 43% of students could not answer 15 out of 20 questions
  - 59% of students could not answer at least 5 out of 20 questions

- Results showed improvement, however the number of students missing questions was still significant.

- Reasons for poor performance – students were surveyed – total 39 responses
  - Students did not understand how to use the AAC when clinical cases were presented
Step 2: Didactic Lectures on AAC

- Initially we presented the AAC directly from the ACR website and discussed how to use it.
- Sample screenshot for clinical presentation of “Breast Pain”.
- Discussion would follow to explain that ultrasound was the first appropriate step in this case.
Step 3 : Case Presentations

- Didactic lectures were thereafter changed into case-based lectures with incorporation of group-based discussion.

- Lectures presented by faculty and residents were reorganized to use the ACR appropriateness criteria but explain them in relation to clinical cases and common presentations (see next 2 slides for examples).

- Students were asked to prepare cases to present to fellow students and discuss the appropriateness of the imaging tests ordered and radiation and contrast risks involved in the cases. The students incorporate the AAC into their case.
  - The case presentation is typically 7-10 minutes in length, presented in a PowerPoint format, and presented to other medical students and a senior resident or attending facilitator.
Common diagnoses – applications of ACR Appropriateness Criteria

- Cough – start with chest xray
  - Finding a pneumonia or pulmonary edema can explain the symptoms without need for additional imaging

- Chest pain – start with chest xray if no clear differential
  - Can start with CT angiography if there is high suspicion of aortic dx

- Dyspnea – start with chest xray
  - May need high resolution CT if there is high risk of malignancy

**these are for acute symptoms**
The first step involves creating a differential based on the clinical scenario:

- Age of the patient → older patients tend to have cardiac pathology, younger tend to have MSK/GI/pulmonary pathology
- Description of the pain → tearing (think dissection), radiating to the arm (think MI), etc.
- Location → can point with a finger (think MSK), epigastric (think esophageal)
- Exacerbating factors → food (think reflux), exercise (think cardiac)

Next step – narrow down the differential to guide imaging
- Cardiac → stress test, echo
- Esophageal → esophogram
- Pulmonary → CXR, chest CT
Case

Patient presents with dysphagia to solids.

What is the next best imaging test?

1st evaluate type of dysphagia and location of symptoms.

2 types of studies that can evaluate ‘dysphagia’.
Step 3: Case Presentations

- New style of didactic lectures incorporate AAC curriculum by presenting a single symptom and the most important next step
  - Important to show students how appropriate next step changes based on clinical suspicion (for instance, ordering CT for pulmonary embolism versus x-ray for pneumonia)

- Positive student response: survey of 25 students showed 100% of students liked this style rather than presentations directly from the ACR website
  - Most common reason cited - ACR guidelines provide 'information overload' on next best step and do not show how to adjust guidelines based on differences in presentation
    - Example: if chest pain is felt to be more related to esophageal pathology versus cardiac pathology, how should imaging guidelines be adjusted?
Step 3 : Case Presentations

- Students then present an interesting case they see during the clerkship and discuss the following:
  - History/physical of a single patient and the workup that patient undergoes
  - Appropriateness of the imaging involved in the workup
  - Discussion of the imaging findings for the patient

- Benefits:
  - More interactive
  - Students learn how to use and apply the AAC in different situations
Step 4 : Group Discussions

- Student led discussions are proctored by faculty member
  - Students discuss a clinical case and ask other students what the next appropriate imaging workups should entail
  - Students must use the AAC to support their assessment of appropriate workups and give examples of how things would change if the presenting symptoms change

- Student surveys – 14 responses – 100% felt a discussion of a case from a presentation and subsequent group discussion of the appropriate next step was beneficial to understanding
  - Most common reason cited – students liked hearing different perspectives on how different students’ clinical suspicions dictated what they would do next
Step 5: Reading Room Involvement

- To better learn about appropriate imaging in practice, students spend time with technologists
  - Students learn common reasons for imaging at the institution
  - Students get a sense of the challenges associated with imaging – they become more cognizant to use imaging appropriately

- Students become involved with calling referring providers and getting history for real patients
  - They then discuss the appropriate next imaging step with residents
  - Students learn about protocoling studies and how this plays into patient workups
Step 5: Reading Room Involvement

- Benefits of student involvement in protocoling

  - Students learn how to apply the AAC in different situations
  - Students gain a new perspective on the role of a radiologist in patient care
  - Students become cognizant of the large volume of studies performed by the department daily and promotes them to think appropriately before ordering imaging
  - Students feel more included in the department
After Implementation of these Changes

- We repeated the pre and post-lecture quizzes about the AAC:
  - Total of 20 questions and a general survey at the end

- Total students taking the clerkship after the switch – 85
  - Pre-lecture quiz:
    - 12% knew about the AAC and how to access it
    - 80% did not answer appropriate imaging on at least 5 of 20 questions
    - 56% did not answer appropriate imaging on at least 15 of 20 questions

  - Post-lecture quiz:
    - 100% knew about the AAC and how to access it
    - 12% did not answer appropriate imaging on at least 5 of 20 questions
    - 4% did not answer appropriate imaging on at least 15 of 20 questions

Significant improvement! [p value <0.05]
Student Responses and Feedback

- Surveys of students were performed each month to assess their ideal learning styles (total responses – 85)
  - 80/85 – preferred case-based learning style
    - 75 of these 80 preferred group discussion with a faculty member or resident present
  - 4/85 – preferred didactic learning style
  - 1/85 – preferred time in the reading room
  - 57/85 (68%) – liked having a dedicated textbook that incorporated basics of imaging and felt this helped understand the AAC
  - Only 17 (20%) of students felt reading room time helped understanding of appropriate imaging
  - 95% of students reported being ‘completely satisfied’ with the clerkship
Conclusions

- Incorporation of the ACR Appropriateness Criteria into a medical student clerkship is helpful and necessary
  - Students cite wanting to learn how to order tests appropriately as a major reason for taking a radiology clerkship

- There are many ways to incorporate the AAC into clerkships, and a multi-activity approach improves teaching and understanding of the AAC

- Creating assessment tools for student knowledge of the AAC is needed to make sure a clerkship’s efforts are effective
Conclusions

- Current techniques can include:
  - A textbook to teach basics of radiology and the advantages and disadvantages of each imaging modality
  - Case-based teaching modules and group discussions to learn how the AAC can be applied in different clinical situations
  - Didactic lectures to help cover basic material that may not be covered in a case-based format
  - Greater involvement in protocoling of studies and shadowing of technologists to learn how the AAC impacts daily practice
References