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INTRODUCTION

The Centers for Medicare and Medicaid Services (CMS) Appropriate Use Criteria (AUC) program requires ambulatory and emergency medicine providers to consult AUC using a CMS-approved clinical decision support mechanism when ordering advanced imaging (CT, MRI or nuclear medicine) in eight priority clinical areas (PCAs). As a CMS approved Qualified Provider Led Entity (QPLE), we research, develop and update appropriate use criteria for the PCAs, which include known or suspected pulmonary embolism (PE).

Pulmonary embolism is a potentially fatal cause of acute cardiopulmonary symptoms. Prompt diagnosis facilitates timely treatment, which ranges from anticoagulation as an outpatient to admission for intravenous heparin, emergent intra-arterial thrombolysis or surgical clot removal. Pulmonary CTA (CT angiography) is widely used in the emergency department, and appropriate use is important to identify positive cases and avoid imaging in patients who don’t have pulmonary embolism, as this carries the risk of overdiagnosis and overtreatment. Use of established, validated clinical scoring systems optimize clinical assessment and management decision-making.

EXAM VS PATIENT SELECTION

Johns Hopkins University School of Medicine QPLE designs appropriate use rules to guide both patient selection and best imaging exam selection:

Exam selection: Data that supports or refutes the utility of an advanced imaging tool (CT, MRI or nuclear medicine) to evaluate a suspected diagnosis.

Patient selection: Clinical history, signs and or symptoms that reflect a reasonable likelihood of the diagnosis in question.

DISCLAIMER

This work is intended for use to assist hospital and health care audiences. However, this work is for informational purposes only, and Johns Hopkins makes no representations or warranties concerning the content or clinical efficacy of this work, or its accuracy or completeness. Johns Hopkins is not responsible for any errors or omissions or for any bias, liability or damage resulting from the use of this work. This work is not intended to be a substitute for professional judgment, advice, or individual root cause analysis.
JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE
ADVANCED IMAGING APPROPRIATE USE CRITERIA
PULMONARY EMBOLISM

MULTIDISCIPLINARY TEAM

JHUSOM requires that all practicing physicians participating in the development of AUC disclose any conflicts. This information is available upon request, for not less than five years after the most recent published update of the relevant appropriate use criteria.

Practicing physician members of the pulmonary embolism AUC development team:

- Nadia Eltaki  Emergency Medicine, Sibley Memorial Hospital
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- Paul O’Rourke  General Internal Medicine, Johns Hopkins Bayview Medical Center
- Panagis Galiatsatos  Pulmonary Medicine, Johns Hopkins Bayview Medical Center
- Javad Azadi  Radiology, The Johns Hopkins Hospital
- Pamela Johnson  Radiology, The Johns Hopkins Hospital

Literature review team:

- Welch Informationist: Katie Lobner
- Evidence Review Lead: Brandyn Lau
- Evidence Analysis Lead: Renee Wilson
LITERATURE REVIEW

Search terms detailed in APPENDIX.

PRISMA
- 471 references imported for screening as 137 studies
  - 18 duplicates removed
- 453 studies screened against title and abstract
  - 395 studies excluded
- 58 studies assessed for full-text eligibility
  - 21 studies excluded
- 37 studies included

Publication type
- 0 meta-analyses
- 4 systematic reviews
- 11 prospective studies
- 18 retrospective studies
- 1 exploratory cohort
- 2 clinical practice guidelines

Oxford grade
- 6 studies Oxford grade 1
- 24 studies Oxford grade 2
- 4 studies Oxford grade 3
- 0 studies Oxford grade 4
- 2 studies Oxford grade 5

METHODOLOGY
- Details about our methodology can be found here: https://www.hopkinsmedicine.org/high-value-health-care/appropriate-use-criteria/index.html#develop
APPROPRIATE USE CRITERIA

CLINICAL SCENARIO: HIGH LIKELIHOOD OF PULMONARY EMBOLISM

Imaging Test: Pulmonary CTA
Patient Selection: This is a life-threatening condition and assignment of high likelihood is at the discretion of the clinician.

CLINICAL SCENARIO: INTERMEDIATE LIKELIHOOD OF PULMONARY EMBOLISM

Imaging Test: Pulmonary CTA
Patient Selection (one of the following):

- Failed PERC AND Wells ≤4 and positive d-dimer OR Wells>4
- Unexplained syncope
- High risk conditions (clotting disorder, cancer)

CLINICAL SCENARIO: LOW LIKELIHOOD OF PULMONARY EMBOLISM

Imaging Test: No advanced imaging is advised.
Patient Selection:

- PERC score of zero
- Failed PERC AND Wells ≤4 with negative d-dimer
APPENDIX: LITERATURE REVIEW DETAILS

The Johns Hopkins University School of Medicine (JHUSOM) initially partnered with the Harvard Medical School (HMS) Library of Evidence (LOE), which performed the necessary literature reviews and evidence grading as required by CMS for the eight PCAs and more. The HMS created a master database that all qualified provider-led entities (QPLEs) can use. JHUSOM creates, modifies and/or endorses our own AUC by reviewing the HMS LOE literature review and evidence grade assigned for each logic point, and by making an assessment regarding whether the review and grading are acceptable when developing or modifying our AUC, as required under CMS AUC program regulations. JHUSOM will disclose use of the HMS LOE resources and outputs on our website, and all faculty members involved in the HMS LOE provide conflict of interest disclosures on their website. To design our original AUC for pulmonary embolism advanced imaging, we searched the HMS LOE for Oxford Grade 1 or 2 evidence, as detailed in the evidence table below. The HMS LOE details its literature review and grading process on its website. HMS LOE identified 13 publications that were graded Level 1 or 2 by the Oxford scoring system. Additionally, the HLOE Clinical Practice Guidelines rules for suspected pulmonary embolism were referenced to confirm consistency.

To update the evidence, we conducted literatures with the support of a Welch informationist as detailed below and in the APPENDIX. Clinical expert teams synthesized the evidence to guide appropriate exam and patient selection.
May 19, 2020:


February 19, 2022