American College of Emergency Physicians®
ADVANCING EMERGENCY CARE

ACEP 22

Title: Emergency Medicine: Appropriate Emergency Department Utilization of CT for Pulmonary Embolism.

Description: Percentage of emergency department visits during which patients aged 18 years and older had a CT pulmonary angiogram (CTPA) ordered by an emergency care provider, regardless of discharge disposition, with either moderate or high pre-test clinical probability for pulmonary embolism OR positive result or elevated D-dimer level.

Measurement Period: January 1, 2023, through December 31, 2023

Measure Steward: American College of Emergency Physicians (ACEP)

Measure Developer: American College of Emergency Physicians (ACEP)

Measure Scoring: Proportion

Measure Type: Process

Initial Population	All emergency department visits during which patients aged 18 years and older had a CT pulmonary angiogram (CTPA) ordered by an emergency care provider, regardless of discharge disposition
Denominator	Equals Initial Population
Denominator Exclusions	Patients with any of the following: Pregnancy
Numerator	Emergency department visits for patients with either: 1. Moderate or high pre-test clinical probability for pulmonary embolism OR 2. Elevated D-dimer level
Numerator Exclusions	Not Applicable
Denominator Exceptions	• Medical reason for ordering a CTPA without moderate or high pre-test clinical probability for pulmonary embolism AND no positive result or elevated D-dimer level (e.g., CT ordered for aortic dissection) • Patients who had CT pulmonary angiogram (CTPA) ordered during an emergency department visit for trauma or dangerous mechanism of injury

Stratification: None

Risk Adjustment: None

Improvement Notation: Higher score indicates better quality

Rationale

The goal of this measure is to reduce the inappropriate ordering of CTPA for pulmonary embolism based on pre-test probability estimation. This measure does not require utilization of a structured clinical prediction rule such as the Wells Score or Geneva Score, however the measure aims to improve efficiency by guiding clinical practice towards use of the PERC rule or d-dimer testing rather than immediate CTPA in low probability patients as indicated. In addition to imaging efficiency, the overuse of

CTPA in ED patients with suspected pulmonary embolism has tangible implications for patient safety. Ionizing radiation from CTPA can increase the lifetime risk of cancer, particularly in young women due to the added vulnerability of breast tissue. Also, the use of iodinated dye places patients at risk of contrast induced nephropathy, which a study by Mitchell and Kline estimated at approximately 8% of all patients undergoing CTPA in the ED.

Despite significant evidence supporting the use of structured clinical assessment in combination with d-dimer testing to develop an approach to the evaluation of patients with suspected PE, there remains poor application of these algorithms in the ED setting. There are numerous studies demonstrating poor application of clinical pre-test assessment to PE testing strategies including:

* Single-center study demonstrated suboptimal application of Wells criteria as 25% of patients with a normal or intermediate probability d-dimer assays subsequently had CTPA ordered to evaluate for PE, with only 2.7% (0.7% of cohort) subsequently having PE.

* A large (5,344 patient) single center cohort study demonstrated that of 2,285 patients with negative d-dimer testing, 166 (7%) underwent CTPA, demonstrating inappropriate use of d-dimer or radiography outside established clinical algorithms.

* Use of an ED protocol that combined structured clinical assessment with d-dimer testing doubles the rate of testing for PE, without increased imaging.

* A small (295 patient) study found that 41% of patients received an inappropriately ordered CTPA based on low pre- test probability of PE. 71% of the study population was considered to have low pre-test probability of PE (based on Wells score) and only 43% of these received D-dimer testing. As with other studies, the authors cite different physician practices and lack of following established clinical guidelines as potential reasons for inappropriate ordering of CTPA in those with low pre-test probability of PE.

* In an observational analysis of Medicare beneficiaries seen in the ED between 2000-2009 for possible PE found that CT utilization has risen while the diagnostic yield has decreased. Physician and geographic variation in practice is noted. More specifically, physicians who have greater experience or are board certified in emergency medicine and noted to have lower CT utilization rates, as well as higher or equivalent diagnostic yield, than those who do not.

* A recent study surveyed physicians in the Veterans Administration (VA) health system found that the majority of hospitals within the system do not require the use of clinical decision rules in addition to d-dimer testing in patients being evaluated for PE. Use of clinical decision rules and d-dimer could decrease the use of CTPA.

Clinical Recommendation Statement

The following evidence statements are quoted verbatim from the referenced clinical guidelines:

Either objective criteria or gestalt clinical assessment can be used to risk stratify patients with suspected PE. There is insufficient evidence to support the preferential use of one method over another. (Level B recommendation) (ACEP, 2011)

For patients with a low or PE unlikely (Wells score <=4) pretest probability for PE who require additional diagnostic testing (eg, positive D-dimer result, or highly sensitive D- dimer test not available), a negative, multidetector CT pulmonary angiogram alone can be used to exclude PE. (Level B recommendation) (ACEP, 2011)

For patients with an intermediate pretest probability for PE and a negative CT pulmonary angiogram result in whom a clinical concern for PE still exists and CT venogram has not already been performed, consider additional diagnostic testing (eg, D-dimer,* lower extremity imaging, VQ scanning, traditional pulmonary arteriography) prior to exclusion of VTE disease. (Level C recommendation) (ACEP, Clinical 2011)

For patients with a high pretest probability for PE and a negative CT angiogram result, and CT venogram has not already been performed, perform additional diagnostic testing (eg, D-dimer,* lower extremity imaging, VQ scanning, traditional pulmonary arteriography) prior to exclusion of VTE disease.

*A negative, highly sensitive, quantitative D-dimer result in combination with a negative multidetector CT pulmonary angiogram result theoretically provides a posttest probability of VTE less than 1%. (Level C recommendation) (ACEP, 2011) In suspected acute PE without shock or hypotension, use of a validated risk stratification scheme (eg, Modified Well's or Revised Geneva scores) should be employed (Class I). (ESC, 2014)

If pretest probability is low or intermediate, D-dimer test should be used in outpatient and emergency department settings (Class I). (ESC, 2014)

Low pretest probability and a negative D-dimer test excludes acute PE (Class I). (ESC, 2014)

D-dimer testing is not recommended in patients with a high pretest probability for acute PE (Class III). (ESC, 2014)

Definition

Pre-Test Clinical Probability for Pulmonary Embolism - For the purposes of this measure, in accordance with the guidelines, either objective criteria (such as a Wells score or Geneva score) or gestalt clinical assessment (expected through physician documentation in the medical record or EHR) can be used to identify patients with suspected pulmonary embolism. Guidance

The data elements, ["Diagnostic Study, Order": "CT Pulmonary Angiogram CTPA"] and ["Diagnostic Study, Order": "Chest CT with Contrast"], are intended to be limited to instances where they are ordered by an emergency care provider to satisfy the measure and specifications intent. This level of attribution at the data element level to a provider's specialty is not able to be demonstrated in current eCQM standards and tools.

The level of analysis for this measure is every emergency department visit with a CT Pulmonary Angiogram ordered during the measurement period. This means that every emergency department visit with a CT Pulmonary Angiogram ordered should be counted as a measurable event for the measure calculation.

Guidance

For the purposes of this measure, the following findings are considered to be synonymous with a high or moderate finding of an assessment of pre-test clinical probability for Pulmonary Embolism. While this measure does not evaluate a low finding of an assessment of pre-test clinical probability for Pulmonary Embolism, we have included it here since it defines what would not meet a moderate or high finding. The synonyms provided below are simply examples and are not intended to represent an exhaustive list of synonyms. For reporting, all synonymous findings or tools used to capture a patient's pre-test clinical probability would need to be mapped to the data element, ["Assessment, Performed": "PreTest Clinical Probability for Pulmonary Embolism"], with an attribute of high or moderate.

Low Pre-Test Clinical Probability for Pulmonary Embolism: Low pre-test probability, Low probability, Unlikely to have pulmonary embolism, Pulmonary embolism unlikely, Low Wells score, PERC negative, Low-risk for pulmonary embolism, Low likelihood of PE

Moderate, Medium, Intermediate Pre-Test Clinical Probability for Pulmonary Embolism: Moderate pre-test probability, Moderate probability, Intermediate Wells score, Intermediate risk for pulmonary embolism, Intermediate likelihood of PE

High Pre-Test Clinical Probability for Pulmonary Embolism: High pre-test probability, High probability, Pulmonary embolism likely, Likely to have pulmonary embolism, High Wells score, High-risk for pulmonary embolism, High likelihood of PE

Global Synonyms: - pulmonary embolism may be noted as PE, pulmonary embolus, VTE or venous thromboembolic disease - risk, suspicion, and significant concern may be used interchangeably - likely and likelihood may be used interchangeably

References

Fesmire FM, Brown MD, Espinosa JA, Shih RD, Silvers SM, Wolf SJ, Decker WW, American College of Emergency Physicians. Critical issues in the evaluation and management of adult patients presenting to the emergency department with suspected pulmonary embolism. Ann Emerg Med. 2011 Jun;57(6):628-52.

Konstantinides SV, Torbicki A, Agnelli G, et al. 2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism: The Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC) Endorsed by the European Respiratory Society (ERS). Eur Heart J. 2014 Aug 29. pii: ehu283. [Epub ahead of print].

Brenner DJ, Hall EJ. Computed tomographyâ€”an increasing source of radiation exposure. N Engl J Med. 2007;357:2277- 2284.

Mitchell AM, Kline JA. Contrast nephropathy following computed tomography angiography of the chest for pulmonary embolism in the emergency department. J Thromb Haemost. 2007;5:50-54.

Kline JA, Mitchell AM, Runyon MS, et al. Electronic medical record review as a surrogate to telephone follow-up to establish outcome for diagnostic research studies in the emergency department. Acad Emerg Med. 2005;12:1127- 1232.

Runyon MS, Richman PB, Kline JA. Emergency medicine practitioner knowledge and use of decision rules for the evaluation of patients with suspected pulmonary embolism: variations by practice setting and training level. Acad Emerg Med. 2007;14:53-57.

Costantino MM, Randhall G, Gosselin M, et al. CT angiography in the evaluation of acute pulmonary embolus. AJR 2008; 191:471-474.

Corwin MT, Donohoo JH, Patridge R, et al. Do emergency physicians use serum d-dimer effectively to determine the need for CT when evaluating patients for pulmonary embolism? Review of 5,344 consecutive patients. AJR 2009; 192:1319-1323.

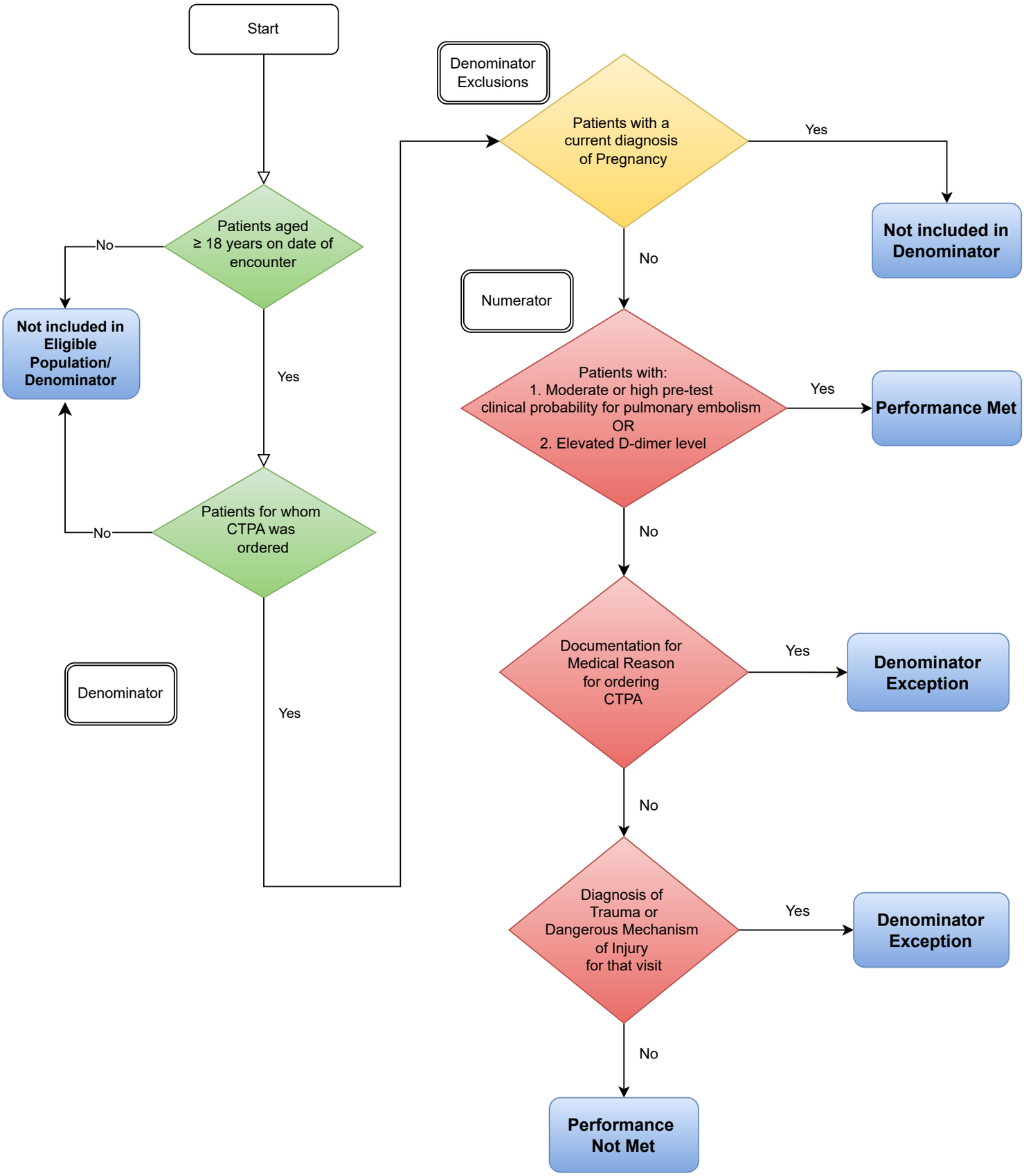
Kline JA, Webb WB, Jones AE, et al. Impact of a rapid rule- out protocol for pulmonary embolism on the rate of screening, missed cases, and pulmonary vascular imaging in an urban US emergency department. Ann Emerg Med. 2004;44:490-502

Osman M, Subedi Kumar S, Ahmed A, Khan J, Dawood T, Rios-Bedoya CF, Bachuwa G. Computed tomography pulmonoary angiography is overused to diagnose pulmonary embolism in the emergency department of academic community hospital. Journal of Community Hospital Internal Medicine Perspectives. 2018. 8(1): 6-10. doi: 10.1080/20009666.2018.1428024.

Venkatesh AK, Agha L, Abaluck J, Rothenberg C, Kabrhel C, Raja AS. Trends and variation in the utilization and diagnostic yield of chest imaging for Medicare patients with suspected pulmonary embolism in the emergency department. American Journal of Roentgenology. 2018;210:572-577.

Disclaimer

These performance measures are not clinical guidelines and do not establish a standard of medical care and have not been tested for all potential applications.


Start
Patients aged ≥ 18 years on date of encounter
No
Not included in Eligible Population/ Denominator
Yes
Patients for whom CTPA was ordered
No
Denominator
Yes
Denominator Exclusions
Patients with a current diagnosis of Pregnancy
Yes
Not included in Denominator
No
Numerator
Patients with:
1. Moderate or high pre-test clinical probability for pulmonary embolism
OR
2. Elevated D-dimer level
Yes
Performance Met
No
Documentation for Medical Reason for ordering CTPA
Yes
Denominator Exception
No
Diagnosis of Trauma or Dangerous Mechanism of Injury for that visit
Yes
Denominator Exception
No
Performance Not Met