UAMS Journal Club Summary
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External Validation of the YEARS Criteria for Pulmonary Embolism

Clinical Bottom Line

On the surface, the YEARS algorithm has been shown to decrease the need for advanced imaging such as CT pulmonary angiography. Both studies examined stated that using the YEARS criteria with the appropriate D-dimer cutoffs would lead to a reduced number of CT scans. However, when comparing the tiered approach to D-dimer cutoffs to age-adjusted d-dimer, there was an increase in patients with PEs that would have been missed using the YEARS criteri. Therefore, there does not seem to be added benefit at this time to YEARS over age-adjusted d-dimer.

PICO Question

P - Patients with clinical concern for pulmonary embolism
I - YEARS criteria (clinical signs of DVT, hemoptysis, PE is most likely diagnosis)
C - Fixed D-dimer cutoff of < 500 ng/mL and other clinical decision tools (Wells' criteria)
O - Safely exclude PE without the need for advanced imaging (CT PE)

Background

Clinical decision tools such as Wells' criteria for pulmonary embolism (PE) and the Pulmonary Embolism Rule-Out Criteria (PERC) are used to risk-stratify patients to determine the need for advanced imaging such as CT angiography of the pulmonary vessels to accurately diagnose PEs. It is clinically important to maximize diagnostic certainty while minimizing the risks associated with CT angiography such as radiation exposure and diagnosis of clinically insignificant small PEs, and the YEARS criteria have been proposed to simplify the approach to risk stratification and reduce the amount of CTs performed to diagnose PE. Utilizing both a 3 criteria algorithm (clinical signs of DVT, hemoptysis, and PE as the most likely diagnosis) and 2-tiered D-dimer cutoff (< 500 ng/mL for at least 1 YEARS criteria met; < 1000 ng/mL for 0 YEARS criteria met). The original study proposed that PE could be safely ruled out using these criteria and decrease the need for CT testing by 14%. Since the original publication, there have been studies that attempt to externally validate the results of the original YEARS paper.

Trial 1

Kabrhel C, Van Hylckama Vlieg A, Muzikanski A, Singer A, Fermann GJ, Francis S, Limkakeng A, Chang AM, Giordano N, Parry B. Multicenter Evaluation of the YEARS Criteria in Emergency Department Patients Evaluated for Pulmonary Embolism. Acad Emerg Med. 2018 Sep;25(9):987-994. doi: 10.1111/acem/13417

Pubmed Link: https://pubmed.ncbi.nlm.nih.gov/29603819/

The Basics:
This study was a retrospective analysis of three of the major prospective analyses regarding YEARS criteria. Briefly, the YEARS criteria was developed as a rule out criteria for PE. If the patient has none of the following criteria, then the YEARS algorithm rules out PE using a d-dimer cut off below 1000 ng/mL instead of 500 (or age adjusted cutoff). If one or more YEARS criteria are met, a fixed d-dimer cutoff must be used. The criteria are:

1. Clinical signs of DVT
2. Hemoptysis
3. PE is most likely or equal to most likely diagnosis

Inclusion Criteria: Patients that presented with symptoms suspicious for PE from combined data from three prospective management outcome studies that included a total of 3414 outpatients with suspected PE.

Exclusion Criteria: 3414 patients' data aggregated and assessed. 100 patients were excluded due to "missing data" leaving 3314 patients for analysis

Primary Outcome: To externally validate this strategy [YEARS Criteria] in an independent cohort.

Secondary Outcome: Comparison of safety and efficacy between YEARS criteria and current standard of practice, age adjusted D-dimer.

Results: Researchers reported external validation of the YEARS diagnostic algorithm in an independent cohort. The rule appeared to safely exclude (failure rate 1.2%). However, when comparing to age-adjusted d-dimer, there were significant limitations. If the patients met YEARS rule out criteria, they were then stratified according to age adjusted D-dimer. 870 patients met both YEARS and age adjusted D-dimer criteria, of these patients 0/870 met failure criteria. 272 patients met YEARS rule out criteria, but not age adjusted d-dimer. Of these patients, 17/272 patients met failure criteria (6.3%).

Our conclusion was that based on the data presented in this paper, the YEARS criteria cannot be safely used to rule out pulmonary embolism using a d-dimer cutoff of 1000 when no YEARS criteria are met based on these data. Though the paper mentioned the overall failure rate of YEARS as 1.2% (17/1423), the YEARS criteria demonstrated a failure rate of 0% (0/870) when there was a discrepancy between YEARS and age adjusted D-dimer (6.3% 17/272). Given this elevated miss rate, it was agreed that YEARS is not currently safe for clinical use as a PE rule out criteria.

Limitations/Bias:

One major limitation is not all patients in the study received what is considered to be the accepted reference standard, which is a CTPE. The patients that were ruled out by age adjusted D-dimer did not receive this study, and whie they followed them up to try to minimize this limitation, it is possible there were additional pulmonary emboli missed in this study.

In terms of application of this paper's findings to our clinical practice at UAMS, the population studied had an overall prevalence of PE of 22%, which our attendings agreed was much higher than our population. We discussed possibilities for this disparity in data which included possible increased prevalence in the studied population and the possibility CTPEs are ordered on more patients at UAMS than in the study's population.

Trial 2

> Eddy M, Robert-Ebadi H, Richardson L, Bellesini M, Verschuren F, Moumneh T, Meyer G, Righini M, Le Gal G. External validation of the YEARS diagnostic algorithm for suspected pulmonary embolism. J Thromb Haemost. 2020 Dec;18(12):3289-3295. doi: 10.1111/jth.15083. Epub 2020 Oct 23.

Pubmed Link: https://pubmed.ncbi.nlm.nih.gov/32869501/

The Basics:

This study was a meta-analysis of 3 European prospective cohort studies enrolling patients between 2000 and 2006 that looked at individuals with concern for PE. Patients in these studies were evaluated sequentially using initial clinician gestalt, serum D-dimer testing, lower extremity compression ultrasonography, and CT pulmonary angiography.

Inclusion Criteria:

Inclusion criteria for this analysis were studies using patients that presented to the ED with clinical concern for PE, characterized by either acute onset of shortness of breath, worsening from baseline dyspnea, or chest pain without a clear etiology.

Exclusion Criteria:

Exclusion criteria for this analysis were patients in the included studies that were missing data points during the sequential analysis of their initial work-up.

Results:

Out of 3314 patients included in the analysis, 734 were diagnosed with PE. Prevalence of PE based on the number of YEARS criteria fulfilled were as follows: 0 YEARS criteria = 8.5% prevalence, 1 YEARS criterion = 33% prevalence, 2 YEARS criteria = 57%

prevalence, 3 YEARS criteria = 75% prevalence. Out of patients that would have not required CT of the pulmonary arteries using the YEARS criteria, 17 patients were found to have PEs of varying clinical significance. All of these patients met 0 YEARS criteria and had D-dimers < 1000 ng/mL. It is important to note that these 17 patients all had D-dimers greater than or equal to the age-adjusted cutoff. The authors of this study state that they have externally validated the YEARS algorithm with 42.9% of patients not requiring CT imaging and a miss rate of 1.2%.

Limitations/Bias:

Main limitations are: Documentation of certain patient encounters did not mention alternative diagnoses or state if PE was the most likely diagnosis, and these patients were excluded from the study. Additionally, the authors recommend caution in using the YEARS algorithm to exclude PE if patients have 0 YEARS criteria documented and have an age-adjusted d-dimer greater than or equal to the relevant cutoff. This raises the question of if age-adjusted D-dimer values alone, without the use of the YEARS criteria, are non-inferior to YEARS for risk stratifying patients with suspected PE and the need for advanced imaging. Additional large volume trials are needed to determine if the YEARS criteria is appropriate for widespread clinical application in the emergency department setting.