Comparison of Wells and YEARS Clinical Decision Rules with D-dimer for Low Risk Pulmonary Embolus Patients presenting to the Emergency Department

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Background

Assessment of pulmonary embolism (PE) remains a diagnostic and investigative burden to Emergency Departments

D-dimer Threshold for Positive result remains controversial;

1) Wells Criteria
   - Traditional threshold D-dimer (≥ 0.5 μg/mL)
   - Age adjusted D-dimer (≥ age (years) x0.01 μg/mL)
   - Doubled Traditional D-dimer threshold (≥ 1.0 μg/mL)
2) YEARS criteria adjusted D-dimer threshold

Wells Criteria vs YEARS Criteria

Criteria	Wells' Score	YEARS
Clinical signs and symptoms of DVT	3.0	1
Heart rate > 100	1.5	-
Immobilisation	1.5	-
Previous VTE	1.5	-
Haemoptysis	1.0	1
Malignancy	1.0	-
PE most likely diagnosis	3.0	1
Outcome of Score	≤ 4 points - for D-dimer stratification > 4 points - proceed direct to Imaging	0 criteria - D-Dimer threshold ≥1.0μg/mL ≥ 1 criteria - D-dimer Threshold ≥0.5μg/mL

Study Aims

- To compare Sensitivity and Specificity of different D-dimer thresholds in Low risk PE (Wells score ≤ 4) presenting to the Emergency Department;
  1. Traditional cut-off D-dimer (≥ 0.5 μg/mL)
  2. Age adjusted D-dimer (≥ age (years) x0.01 μg/mL)
  3. YEARS criteria adjusted D-dimer threshold
  4. Doubled Traditional D-dimer threshold (≥ 1.0 μg/mL)

Methodology

- Retrospective chart review January 2013 - August 2016
- Single center adult only tertiary referral ED in Sydney
- Inclusion criteria;
  - D-dimer ordered for PE risk stratification
- Two Researchers independently assessed each patient's risk for PE by applying Two Tier Wells' Criteria for PE to identify low risk patients
  - Wells score >4 were excluded from primary analysis
- Follow up for 3 months

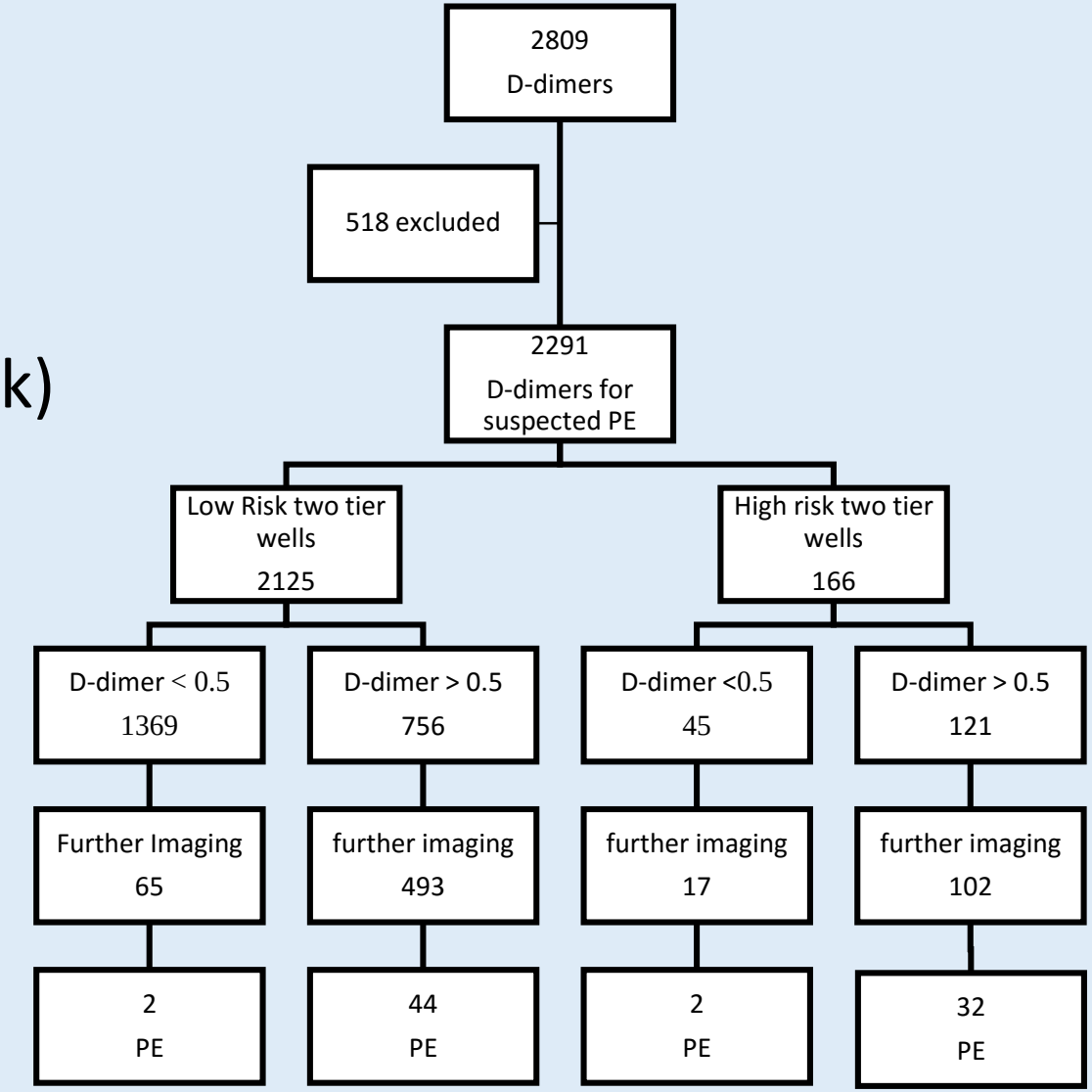
Data Analysis

Primary Analysis:

- The primary analysis was to assess the sensitivity and specificity of the following CDR for diagnosing PE in Low risk Wells:
  - Traditional threshold (≥ 0.5 μg/mL).
  - Age-adjusted threshold to all patients over the age of 50, using an algorithm defined as age (years) x0.01 μg/mL.
  - Doubled traditional threshold (≥ 1μg/mL).
  - YEARS criteria applied to D-dimer threshold

Results

- 42 month period 2809 D-dimers for PE
- 2125 for Wells score ≤ 4 points (Low risk)
    - **46 PEs (2.2%)**
- Median age 49 yo (IQR 36 - 64)
- Presenting symptomology
    - Pleuritic chest pain 1200 (56%)
    - Dull chest pain 640 (30%)
    - SOB 1019 (48%)



Flowchart using Traditional D-dimer Cut-Off

Results Primary Analysis of D-dimer Thresholds

CDR	Outcome by the CDR	Patient number (n= 2125) (%)	Outcome		Sens. (%) (95% CI)	Spec. (%) (95% CI)	PPV (%) (95% CI)	NPV (%) (95% CI)
			No PE	PE				
Traditional D-dimer	Negative	1369 (64%)	1367	2				
	Positive	756 (36%)	712	44	**95.6** (85.5 – 99.2)	**65.6** (63.7 – 67.8)	**5.8** (4.4 – 7.7)	**99.9** (99.5 – 99.7)
Age –adjusted	Negative	1494 (70%)	1491	3				
	Positive	631 (30%)	588	43	**93.5** (82.5 – 97.8)	**71.7** (69.7 – 73.6)	**6.8** (5.1 – 9.1)	**99.8** (99.5 – 100)
Doubled traditional	Negative	1792 (84%)	1778	14				
	Positive	333 (16%)	301	32	**69.6** (55.2 – 80.1)	**85.5** (83.9 – 87.0)	**9.6** (6.9 – 13.3)	**99.2** (98.7 – 99.5)
YEARS criteria	Negative	1756 (83%)	1747	9				
	Positive	369 (17%)	332	37	**80.4** (66.8 – 89.4)	**84.0** (82.4 – 85.5)	**10.0** (7.4 – 15.5)	**99.5** (99.0 – 99.7)

Missed PEs vs Reduction in Imaging burden compared to Traditional D-dimer threshold

Total patients = 2125

Total PEs = 46

CDR	Missed PEs (%)	Reduction in imaging* Total = 493
Traditional D-dimer	2 (4.3%)	-
Age –adjusted	3 (6.5%)	70 (14.2%)
Doubled D-dimer	14 (30.4%)	245 (50.0%)
YEARS criteria	9 (20.0%)	217 (44.0%)

*Reduction in number of CTPA or V/Q performed compared to Traditional D-dimer threshold

Discussion

1. Low Prevalence PE 2.2%
   - Suggested increase in risk averse practice
   - Consideration – Non-imaged D-dimer positive

2. Comparison of CDR D-dimer Thresholds
   - Age Adjusted D-dimer
     - Maintains good sensitivity, improves specificity
   - YEARS and Doubled Threshold
     - Significant imaging reduction and improved specificty
     - Reduced sensititivity and missed clinically significant PEs

Limitations

- Study setting
  - Single center
- Selection
  - Identified by D-dimer performed excluding patients who either correctly or incorrectly had PE excluded without a D-dimer
- Design
  - No uniform guideline followed to investigative for PE
  - Clinical symptom was not documented then presumed not present
  - Follow up limited to 3 months in same health network

Conclusions

1. Cohort of 2125 low-risk PE patients - low rate of PE of 2.2%
   - Suggestive of increasing risk averse practice and investigation burden in suspected PEs

2. Comparing the D-dimer Thresholds in Low Risk Patients
   - Age adjusted D-dimer threshold in improved specificity, saved significant imaging and maintained a high sensitivity

Acknowledgments

- Supervisor and Co-author
  - Dr Angela L Chiew Bsci (Med) MBBS, FACEM
    - Department of Emergency Medicine, Prince of Wales Hospital

- Co-authors
  - Olivia Chua
    - Prince of Wales Hospital Clinical School, University of NSW
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  - Elia Vecellio Bpsych (Hons) MSc (Research)
    - NSW Health Pathology, Prince of Wales Hospital

Thank you for listening
Questions?

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