Impact of implementation of the Simplified Wells Criteria on referrals for pulmonary embolism

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Background

- Conventional pulmonary angiography was previously regarded as the gold standard for the diagnosis of PE.

- Sensitivity of 98% and specificity between 95-98%.

- Limitations:
  - Invasive
  - Performed in large centres only
  - Potential to miss PE that could be detected with CTPA, particularly at the subsegmental level
CT pulmonary angiogram (CTPA) has replaced catheter angiography as the study of choice to evaluate patients with suspected pulmonary emboli and underlying pulmonary disease.

- Allows accurate assessment of the peripheral pulmonary arteries to the fifth order (subsegmental branches)
Background

- PIOPED II study: CTPA has overall diagnostic sensitivity of 83% (95% CI, 76-92%) and specificity of 96% (95% CI, 93-97%).

- The study emphasized the importance of determining a pretest clinical probability for PE.

- CTPA with concordant clinical assessment had a 92-96% PPV and 89-95% NPV.
Background

Simplified Wells Score (Gibson et al, 2009)

- Assigns 1 point to each of 7 clinical criteria
  - score of $\leq 1$ - “PE unlikely” (prevalence of PE - 11.0%)
  - score of $>1$ - “PE likely” (prevalence of PE - 35.8%)
- Statistically equivalent to the Original and Modified Wells Scores
- In patients with PE “unlikely” and negative D-dimer, only 0.5% developed VTE in 3 months of followup
Background

- No publications to show the impact of the use of the Wells or simplified Wells Criteria on the number of CTPAs performed.
Aim

- To determine the impact of implementation of the simplified Wells Criteria on the volume of referrals for suspected PE

- To decrease the number of negative CTPA studies by the implementation of the simplified Wells Criteria.
Aim: Overview

- Study Group: Patients with a high pre-test probability for PE who require a CTPA.
- Intervention: Risk stratification with the simplified Wells criteria.
- Endpoint: To decrease the number of negative CTPA studies.
Method

- Retrospective Study (N=189).

- Only emergency department patients included
  - Felt to be most representative of the general public

- Implemented standardized requisition requiring adherence to algorithm based on simplified Wells Score on January 1, 2013

- Collected and compared data from Jan-Mar 2012 and Jan-Mar 2013.
# Method

<table>
<thead>
<tr>
<th>Simplified Wells Score</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Clinical Signs/ symptoms of DVT</td>
<td>+1</td>
</tr>
<tr>
<td>• Alternative Dx is less likely than PE</td>
<td>+1</td>
</tr>
<tr>
<td>• Heart rate greater than 100</td>
<td>+1</td>
</tr>
<tr>
<td>• Immobilization or surgery, previous 4 weeks</td>
<td>+1</td>
</tr>
<tr>
<td>• Previous DVT or PE</td>
<td>+1</td>
</tr>
<tr>
<td>• Hemoptysis</td>
<td>+1</td>
</tr>
<tr>
<td>• Malignancy with treatment within 6 months or palliative</td>
<td>+1</td>
</tr>
<tr>
<td><strong>D-dimer</strong></td>
<td></td>
</tr>
<tr>
<td><strong>D/w Thrombo</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total: ____
Method

Clinical Suspicion of PE in ED

Simplified Wells Score

≤ 1

PE Unlikely

No PE

D-dimer

Empiric Treatment

CT PA available only with Thrombosis consult

> 1

PE Likely

CT PA

Treatment for VTE and Thrombosis consult

No PE
Method

- Data collection:
  - Age
  - Gender
  - Study Time: In hours, 5pm - Midnight, Midnight - 8am
  - D-Dimer, if applicable
  - Previous CXR result
  - Symptoms and Risk Factors (Prior to implementation of standardized requisition)
  - Simplified Wells Score (After implementation of standardized requisition)
  - CTPA positive or negative
Results

• 21.7% reduction in studies after introducing a standardized algorithm using the simplified Wells Score. (N=189)

  • 106 studies in January – March 2012.
  • 83 studies in January – March 2013.

• Increase in number of positive studies to 21.7% from 13.2%. 
In 2012, 14 / 106 studies (13.2%) were positive for PE

In 2013, 18 / 83 studies (21.7%) were positive for PE

\[ p = 0.12 \]
## Results

### Demographics

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>106</td>
<td>83</td>
<td>189</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Age (yrs)</strong></td>
<td>55.9</td>
<td>61.4</td>
<td>58.3</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>70/106 F (66.0%)</td>
<td>50/83 F (60.2%)</td>
<td>120/189 F (63.5%)</td>
<td>0.41</td>
</tr>
</tbody>
</table>
## Results

### CTPA Scan Times

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>In hours</td>
<td>60 (56.6%)</td>
<td>45 (54.2%)</td>
<td>105 (55.6%)</td>
</tr>
<tr>
<td>5pm-Midnight</td>
<td>33 (31.1%)</td>
<td>25 (30.1%)</td>
<td>58 (30.7%)</td>
</tr>
<tr>
<td>Midnight-8am</td>
<td>13 (12.3%)</td>
<td>13 (15.7%)</td>
<td>26 (13.8%)</td>
</tr>
</tbody>
</table>
# Results

Positive PE studies by time of scan

<table>
<thead>
<tr>
<th>Time of Scan</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>In hours</td>
<td>9/60 (15.0%)</td>
<td>10/45 (22.2%)</td>
</tr>
<tr>
<td>5pm- Midnight</td>
<td>3/33 (9.1%)</td>
<td>5/25 (20.0%)</td>
</tr>
<tr>
<td>Midnight- 8am</td>
<td>2/13 (15.3%)</td>
<td>3/13 (23.1%)</td>
</tr>
</tbody>
</table>

No statistically significant difference in the yield of studies across scan times (p = 0.70 in 2012, p = 0.97 in 2013)
Summary of Results

- 21.7% reduction in the number of studies with enforced use of an algorithm based on the simplified Wells Score.

- Higher percentage of positive PE studies after implementation of the algorithm (21.7% vs 13.2%) – but not statistically significant ($p = 0.12$)

- No correlation between the scan time and the percentage of positive PE studies.
Limitations

- The patient predisposition from ER is unclear.
- No standardized method of information transfer to ER physicians and residents.
- Assumed strict compliance with only complete forms accepted by radiology.
References


