An Audit into the Clinical Appropriateness of CT Pulmonary Angiogram Requests in the Investigation of Acute Pulmonary Emboli

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INTRODUCTION

• Acute pulmonary embolism (PE) is often inappropriately investigated due to the non-specificity of the presenting signs and symptoms 1-5.

• It is thought that PEs have a 10-30% mortality if left untreated 1-5. However, inappropriate investigations to investigate these are often performed with serious clinical, patient safety, and financial considerations 1-5.

• With all this in mind, our aims were:
  1. To assess the clinical appropriateness of CT pulmonary angiogram (CTPA) requests in the investigation of acute PE, and;
  2. To review the impact of a digital clinical decision making tool on this
BACKGROUND

• Our study was based on audit standards suggested by the National Institute for Health and Care Excellence (NICE) guidelines based in the United Kingdom (UK).^6^ NICE provide guidance, advice and evidenced based information to clinicians in the UK to inform their clinical practice. These guidelines suggest that all CTPA requests for a PE should be risk stratified using a decision making tool (Wells Criteria) in the request.^6^

• Patients are then stratified into high and low risks groups based on their calculated Wells Score (high: >4; low: <4).^6^
  - **Low risk** patients should then have a d-dimer blood test.
  - **All high risk** patients, or patients with a positive d-dimer should have a CTPA unless contraindicated.
  - **All patients with a Wells score of less than 4** (low risk) or **absent or negative** d-dimers should not have a CTPA.

NICE GUIDELINES

METHODS

• We conducted a prospective study looking at all the CTPA requests carried out at our medium-sized, district general hospital within two months, and collected data on patient demographics, clinical details, the use of a pre-test probability scoring (Wells score) and d-dimer levels.

• After introducing a decision making tool into the electronic request system at the hospital, we reassessed the appropriateness of these requests.
## Audit Standards and Current Practice

<table>
<thead>
<tr>
<th>Standards</th>
<th>Recommended^2</th>
<th>Current Practice (Pre Intervention)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All CTPA requests for PE should have a documented Wells score in the clinical details section.</td>
<td>&gt;95%</td>
<td>11.67%</td>
</tr>
<tr>
<td>All high risk patients (Wells &gt; 4 &amp; Wells &lt;=4 + positive D-dimer) should have a CTPA.</td>
<td>&gt;95%</td>
<td>100%</td>
</tr>
<tr>
<td>All low risk patients (Wells &lt;=4) should have D-dimer levels.</td>
<td>&gt;95%</td>
<td>61.9%</td>
</tr>
<tr>
<td>No patient with Wells &lt;=4 + negative/not requested D-dimer should have a CTPA.</td>
<td>0 scans</td>
<td>27 scans</td>
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</tbody>
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## RESULTS

### ALL PATIENTS (n=159)

- **Outpatient CTPA Requests (n=9)**
  - Cancelled by department (n=23)
  - Typical History of PE on Request (i.e. WELLS Score >4) (n=57)
    - PE found (n=11)
    - PE not found (n=46)
  - Non Typical History of PE on Request (i.e. Wells Score <=4) (n=63)
    - D Dimer Requested
      - Yes (n=39)
        - Raised (n=36)
        - Not Raised (n=3)
      - No (n=24)
    - No PE Found (n=3)
    - No PE Found (n=21)
  - All Other Inpatient CTPA Requests (n=150)
    - Excluded (n=7)

### PRE INTERVENTION

- PE Found (n=1)
- No PE Found (n=35)
- PE Found (n=0)
- No PE Found (n=3)
- PE Found (n=3)
- No PE Found (n=21)
**RESULTS**

**ALL PATIENTS (n=114)**

**Outpatient CTPA Requests (n=14)**
- CTPA cancelled by department (n=19)
- Excluded (n=2)

**All Other Inpatient CTPA Requests (n=100)**
- Typical History of PE on Request (i.e. WELLS Score >4) (n=44)
  - PE found (n=6)
  - PE not found (n=38)
- Non Typical History of PE on Request (i.e. Wells Score <4) (n=35)
  - D Dimer Requested?
    - Yes (n=29)
    - No (n=6)

**Comparative Findings**

- **Pre-intervention**, 159 requests were collected (120 included, 39 excluded).
- 11.6% had a documented Wells score; for those without, scores were retrospectively calculated based on the clinical description provided.
- Patients were stratified into high (47.5%) and low Wells score groups (52.5%).
  - For the high scoring group (Wells >4), 19.3% of patients had a PE.
  - For the low scoring group (Wells <4), 61.9% had d-dimers performed; 2.8% of patients had a PE in the positive d-dimer subgroup, and 12.5% and 8% in the absent and negative d-dimer groups respectively.
  - In the low Wells score group, 37 patients underwent scans with absent or negative d-dimers.
- **Post intervention**, 114 requests were collected (79 included, 35 excluded).
  - 94.9% had a documented Wells score.
    - In the high scoring group, 13.6% of patients had a PE.
    - For the low scoring group, 82.9% had d-dimers performed; 8% of patients had a PE in the positive d-dimer subgroup, and 15.7% and 0% in the absent and negative d-dimer subgroups respectively.
    - 30 patients in the low Wells score group underwent scans with absent or negative d-dimers.
CONCLUSIONS

- **Risk stratification** of suspected PE using the Wells criteria is underutilised.

- Use of a decision making tool is an evidence-based way to:
  - Ensure there is *increased documentation* of Wells scores for CTPA requests
  - Ensure there are *increased d-dimer* tests in low Wells score patients
  - **Reduce the number of inappropriate scans** when patients have a low Wells score or have absent or negative d-dimer tests

- Overall, integrated decision making tools **improve adherence to national guidelines**, potentially **reduce unnecessary patient radiation dose**, and help radiology departments **manage the high clinical demand** for scans.

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**References**


