Fatigued but not intellectually compromised

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Introduction

• Fatigue and sleep loss are associated with:
  – Reduced attention, vigilance, alertness
  – Impaired memory and ability to make decisions
  – Prolonged reaction time
  – Poor communication skills

• Effect of fatigue and sleepiness on diagnostic reasoning skills in overnight shift workers are largely unknown.
Introduction

• Interpretation of ECGs for ST-segment elevation myocardial infarction (STEMI) is common and performed with high level of accuracy.
  – Requires integration of intuitive and analytic skills
• Analytic skills are vulnerable to a single night loss of sleep.
Objectives

• Primary objective:
  – A pairwise difference in overall accuracy of cath lab activation (CLA) between daytime and overnight conditions.

• Secondary objectives:
  – Pairwise difference in number of overcall’s and under call's.
  – Confidence in treatment decisions.
Hypothesis

• Fatigue from working overnight shifts will decrease the accuracy of EM resident interpretation of ECGs for STEMI and impair their ability to make appropriate treatment decisions.
Methods

• Study design
  – Prospective within-subject.

• Setting
  – Multicenter.

• Subjects
  – EM-3 residents.
Methods

• Protocol
  – An ECG test packet, developed by study investigators, consisted of STEMI and STEMI mimics.
  – Subjects completed a fatigue questionnaire and the ECG test packet during didactic conference (daytime).
  – At least 1 month later at the end of the first in a series of overnight shifts, subjects completed a second fatigue questionnaire and ECG test packet (overnight).
  – Subjects answered (yes/no) if the patient required CLA based upon the study ECGs.
  – Subjects recorded confidence in treatment using an 11-point numeric rating scale.
Methods

• Measures
  – Percentage correct of CLA
  – Confidence in treatment decision
  – Fatigue measures:
    – Stanford Sleepiness Scale
    – 100-mm VAS for sleepiness, mental and physical fatigue
    – Occupational Fatigue and Exhaustion Recovery scale- OFER15
Methods

• Analysis
  – Pairwise differences in overall accuracy of CLA between daytime and overnight conditions were compared with Wilcoxon signed rank test.
  – Pairwise differences in under calls and overcalls were compared with McNemar’s Test.
  – Fatigue measures were compared with non-parametric tests.
Methods

• Sample size
  – 23 paired observations demonstrated, with 80% power and 0.05 chance of error (2 tailed), a 10% difference in the primary outcome.
Results

- 23 residents enrolled

<table>
<thead>
<tr>
<th>Scale</th>
<th>Daytime, Median (IQR)</th>
<th>Overnight, Median (IQR)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanford Sleepiness Scale</td>
<td>2 (2,3)</td>
<td>5 (3,6)</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>Sleepiness VAS, mm</td>
<td>30 (14,43)</td>
<td>72 (62,81)</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>Physical fatigue VAS, mm</td>
<td>36 (20,59)</td>
<td>68 (59,80)</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>Mental fatigue VAS, mm</td>
<td>33 (20,59)</td>
<td>74 (59,80)</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>OFER-15</td>
<td>34 (29,42)</td>
<td>34 (29,43)</td>
<td>0.48</td>
</tr>
</tbody>
</table>
Results

• Percentage correct of CLA was not significantly different between daytime and overnight; 70% (50,80) vs. 70% (60,80), p=0.82.
## Results

<table>
<thead>
<tr>
<th></th>
<th>Daytime # under call</th>
<th>Overnight # under call</th>
<th>P</th>
<th>Daytime confidence NRS, median (IQR)</th>
<th>Overnight confidence NRS, median (IQR)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWMl</td>
<td>5</td>
<td>11</td>
<td>0.07</td>
<td>8 (5,10)</td>
<td>8 (7,9)</td>
<td>0.59</td>
</tr>
<tr>
<td>LBBB</td>
<td>8</td>
<td>4</td>
<td>0.34</td>
<td>8 (6,8)</td>
<td>8 (7,10)</td>
<td>0.57</td>
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<tr>
<td>LBBB with IWMl</td>
<td>5</td>
<td>2</td>
<td>0.38</td>
<td>8 (6,10)</td>
<td>7 (5,8)</td>
<td>0.29</td>
</tr>
<tr>
<td>RBBB with MI</td>
<td>12</td>
<td>9</td>
<td>0.58</td>
<td>6 (6,8)</td>
<td>6 (5,7)</td>
<td>0.94</td>
</tr>
<tr>
<td>Posterior wall MI</td>
<td>9</td>
<td>10</td>
<td>1</td>
<td>7 (6,8)</td>
<td>6 (5,8)</td>
<td>0.33</td>
</tr>
<tr>
<td>Antero septal MI</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>7 (5,8)</td>
<td>6 (5,8)</td>
<td>0.92</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th></th>
<th>Daytime # overcall</th>
<th>Overnight # overcall</th>
<th>P</th>
<th>Daytime confidence NRS, median (IQR)</th>
<th>Overnight confidence NRS, median (IQR)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericarditis</td>
<td>11</td>
<td>5</td>
<td>0.11</td>
<td>7 (6,8)</td>
<td>6 (5,8)</td>
<td>0.2</td>
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<tr>
<td>RBBB</td>
<td>4</td>
<td>6</td>
<td>0.69</td>
<td>7 (6,8)</td>
<td>7 (5,8)</td>
<td>0.94</td>
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<tr>
<td>LVH</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>7 (5,8)</td>
<td>7 (6,8)</td>
<td>0.85</td>
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<td>AIVR</td>
<td>6</td>
<td>12</td>
<td>0.03</td>
<td>8 (5,9)</td>
<td>6 (5,8)</td>
<td>0.27</td>
</tr>
</tbody>
</table>
Discussion/ Limitations

• Overnight workers experience fatigue
• Scoring was unchanged
  – Test difficulty set at 80%
  – Study design lacks actuality
    • Colleague or cardio consult, availability of EMR, opportunity to repeat ECG
• Type II error
  – Example: subtle IWMI and AIVR
Conclusions

• Despite a measurable degree of fatigue, EM-3 residents experience no significant change in their ability to accurately interpret an ECG for STEMI and make treatment decisions.