Transcutaneous ear probe oxygenation readings are significantly higher than finger probe oxygenation readings in CF adults

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Introduction

• Accurate assessment of arterial oxygen saturations saturations (SaO2) is vital in the optimal management of people with CF, particularly in those with severe lung disease

• Arterial blood gases (ABGs) accurately measure SaO2, pH and partial pressure of oxygen (PaO2) and carbon dioxide (PaCO2) but are painful and repeated measurements can result in vascular complications. Earlobe arterialised capillary blood gases (CBGs) have therefore gained popularity as they provide accurate estimates of pH and PaCO2 are relatively painless and the procedure requires less training

• CBGs have been shown to have good correlation with ABGs when estimating SaO2 in patients with chronic lung disease, with increased accuracy in hypoxic patients1

• Transcutaneous finger probe pulse oximetry to measure peripheral capillary oxygen saturations (SpO2) is routinely used to estimate SaO2, although the results are known to be less accurate than ABGs. ‘Hands free’ transcutaneous ear probe pulse oximetry can enable more convenient assessment of SpO2

Aim

• The aim of this pilot study was to compare simultaneous assessments of SaO2 by earlobe CBG or radial ABG, finger probe and ear probe SpO2 in adults with CF and normal controls

Methods

• In this pilot, prospective, observational study, we recorded patient demographics and spirometry and performed simultaneous earlobe CBG or radial ABG, finger probe and ear probe SpO2 in adults with CF and normal controls. Finger probe and ear probe SpO2 were recorded by the same oximeter (PalmSAT(r) 2500 series by Nonin Medical Inc.) using the appropriate ear and finger sensors

Results

• 21 sets of observations (19/21 CBGs) were recorded in 14 patients (6 male, mean age 29 yrs, mean FEV1 30% predicted)

• 8/21 observations were taken with patients breathing room air and 13/21 with supplemental oxygen (mean 3.1 L/min)

• 3 sets of observations (3/3 CBGs) were performed in 3 normal controls (1 male, mean age 31 yrs)

• In patients, ear probe SpO2 was significantly higher than finger probe SpO2 (*p<0.001) and finger probe SpO2 was significantly lower than SaO2 (^p=0.01). See Table and Graph for full results

Patient Ear probe and Finger probe SpO2 and ABG/CBG SaO2 (n=21)

<table>
<thead>
<tr>
<th>Mean Ear Probe</th>
<th>Mean Finger Probe</th>
<th>Mean ABG/CBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO2 (%)</td>
<td>SpO2 (%)</td>
<td>SaO2 (%)</td>
</tr>
<tr>
<td>Patients (n=21)</td>
<td>94.0*</td>
<td>92</td>
</tr>
<tr>
<td>Controls (n=3)</td>
<td>100</td>
<td>98</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>PaO2 (kPa)</th>
<th>pH</th>
<th>PaCO2 (kPa)</th>
<th>HCO3 (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.14</td>
<td>7.42</td>
<td>7.35</td>
<td>32</td>
</tr>
<tr>
<td>12.9</td>
<td>7.42</td>
<td>5.4</td>
<td>26.5</td>
</tr>
</tbody>
</table>

• In patients, SpO2 was <88% more frequently on finger probe than on ear probe pulse oximetry (7 patients vs. 0 patients)

• In patients, SpO2 was <88% more frequently on finger probe pulse oximetry than SaO2 was <88% on ABG/CBG (7 patients vs. 2 patients)

Conclusions

• These results suggest that;

• Estimates of arterial oxygenation via ear probe pulse oximetry are significantly higher than finger probe

• Finger probe pulse oximetry significantly under-estimates arterial oxygenation compared to CBG/ABGs. This finding is particularly clinically relevant in patients with or at risk of Type 2 respiratory failure, in whom over- oxygenation is potentially harmful

• These findings demonstrate the potential for inappropriately administering or withholding oxygen when basing clinical decisions on finger probe or ear probe SpO2 results and highlights the need for further investigation into the best way to achieve safe and accurate assessment of arterial oxygen saturations in CF adults in the future

References