Adjustment of DLCO measurements

1 Introduction

Adjustments of DLCO measurements are described in detail the 2005 ERS/ATS statement. In the paper, however, the adjustment is described as a change of the DLCO predicted values. After several discussions with opinion leaders, we have to conclude that it is more common to compute a DLadj value that is computed from the measured DLCO value. This DLadj value is then compared to the (unchanged) predicted values. The following table describes this:

<table>
<thead>
<tr>
<th>Comment</th>
<th>Parameter</th>
<th>Predicted</th>
<th>% Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DLCO&lt;sub&gt;meas&lt;/sub&gt;</td>
<td>DLCO&lt;sub&gt;pred&lt;/sub&gt;</td>
<td>DLCO&lt;sub&gt;pred&lt;/sub&gt; / DLCO&lt;sub&gt;meas&lt;/sub&gt;</td>
</tr>
<tr>
<td>ERS/ATS statement</td>
<td>DLCO&lt;sub&gt;meas&lt;/sub&gt;</td>
<td>DLCO&lt;sub&gt;pred&lt;/sub&gt; * α</td>
<td>DLCO&lt;sub&gt;pred&lt;/sub&gt; * α / DLCO&lt;sub&gt;meas&lt;/sub&gt;</td>
</tr>
<tr>
<td>EasyOne Pro</td>
<td>DL&lt;sub&gt;adj&lt;/sub&gt; = DLCO&lt;sub&gt;meas&lt;/sub&gt; * β</td>
<td>DLCO&lt;sub&gt;pred&lt;/sub&gt;</td>
<td>DLCO&lt;sub&gt;pred&lt;/sub&gt; / (DLCO&lt;sub&gt;meas&lt;/sub&gt; * β)</td>
</tr>
</tbody>
</table>

As can be seen from the table above, the %Predicted is the same if β = 1 / α. This means that the equations of the ERS/ATS statement have to be inverted (i.e. the factor is multiplied instead of divided). If compared to the original formulas in the ERS/ATS statement, the following formulas are therefore 'inverted' (multiplication instead of division and vice versa).

2 Adjustment for hemoglobin

The following formula is applied to correct for hemoglobin:

Male adults (age ≥ 15): \( DL_{adj} = \frac{DLCO}{1.7 \times \frac{Hb}{10.22 + Hb}} \) Hb in g/dL

Female and children (age < 15): \( DL_{adj} = \frac{DLCO}{1.7 \times \frac{Hb}{9.38 + Hb}} \) Hb in g/dL

Unit conversion: Hb [g/dL] = Hb [mmol/L] / 0.616 (according to other sources the factor is 0.6206)

Allowed range for Hb: 0 to 100 g/dL.

Default value for male adults (age ≥ 15): 14.6 g/dL (9.00 mmol/L)

Default value for female and children (age < 15): 13.4 g/dL (8.26 mmol/L)

3 Adjustment for \( P_{A,O2} \) or altitude

The following formula for DLadj is applied if the patient uses supplemental O₂:

\( DL_{adj} = DLCO \times (1 + 0.0035 \times (PAO_2 - 100)) \) \( PAO_2 \) in mmHg

If no supplemental O₂ is applied the following formula is always applied to correct for altitude. The partial pressure of O₂ in the lungs is computed by subtracting the water vapor pressure in the lungs (47 mmHg) from the ambient pressure and multiplying it with the O₂ concentration:

\( DL_{adj} = DLCO \times (1 + 0.0031 \times (PIO2 - 150)) \) \( PIO2 = (Pamb - 47) \times 0.20942 \)

Unit conversion: P [mmHg] = P [mbar] * 0.750

\( P_{\text{avg}} = 760 \left(1 - \frac{0.0065 \cdot h}{288}\right)^{5.255} \) in mmHg, h in meters

Pressure at altitude: 100 to 750 mmHg

Feet to meter conversion: h [m] = h [ft] / 3.28084
4 Adjustment for COHb concentration and CO back pressure

Adjustment for Carboxyhemoglobin is performed as follows:

\[
DLadj = \frac{DLCO}{(102\% - COHb\%)} \quad COHb \text{ in } \%
\]

Allowed range for COHb: 0 to 100%
Default value: 2% at this value DLadj equals DLCO

5 Example of DLCO adjustment

The following shows how combined adjustments are performed:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adjustment for men</th>
<th>Adjustment for women and children &lt; 15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin</td>
<td>0.7023</td>
<td>0.69292</td>
</tr>
<tr>
<td>(P_A,\text{O}_2)</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>COHb</td>
<td>1.38889</td>
<td>1.38889</td>
</tr>
<tr>
<td><strong>Total correction factor</strong></td>
<td>1.6582</td>
<td>1.6361</td>
</tr>
</tbody>
</table>