Professor Lutz Beckert
Academic Head, Department of Medicine Respiratory
University of Otago, Christchurch

Saturday, August 13, 2016

14:00 - 14:55  WS #113: Lung Disease, Oxygen Therapy and Air Travel
15:05 - 16:00  WS #124: Lung Disease, Oxygen Therapy and Air Travel (Repeated)
Lung Disease, Oxygen Therapy and Air Travel

- Commercial aircraft cabin
- Organising tests and oxygen
- Medical Emergencies
Respiratory Physiology

Response to Airline Flight in Health Passengers

Kelly P et al. Normobaric Hypoxia Inhalation Test versus Response to Airline Flight in Health Passengers. Aviation, Space and Environmental Medicine 2006; 77:1143
Hypoxemia in Health Subjects as Moderate Altitude

Air Travel Hypoxemia in Passengers with COPD

Kelly P et al. Air Travel Hypoxemia vs the Hypoxia Inhalation Test in Passengers with COPD. Chest 2008;133:920-926
Individual SpO\textsubscript{2}

![Graph showing SpO\textsubscript{2} and Pb levels over time at different altitudes.](image)

- SpO\textsubscript{2} (%)
- Pb (mmHg)

- Time (minutes)

- Altitudes:
  - SL
  - 1540 m
  - 2086 m
Individual SpO$_2$
Individual $\text{SpO}_2$

SpO$_2$ (%) vs. Time (minutes)

- SpO$_2$ values:
  - 20
  - 30
  - 40
  - 50
  - 60
  - 70
  - 80
  - 90
  - 100

- Time (minutes):
  - 1
  - 61
  - 121
  - 181
  - 241
  - 301
  - 361
  - 550
  - 600
  - 650
  - 700
  - 750
  - 800

- Pb (mmHg):
  - 20
  - 86

- Altitude:
  - SL: 1540 m
  - 2086 m

- Images:
  - People and a vehicle at 1540 m
  - Vehicle at 2086 m
  - Mountains
Individual SpO$_2$
Individual SpO₂

SpO₂ (%)

Pb (mmHg)

Time (minutes)

SL 1540 m

1540 m
Individual SpO₂

![Graph showing SpO₂ (%), SL, Pb (mmHg), and time (minutes) over altitude changes from SL to 1540 m to 2086 m.](image)
Individual SpO₂

SpO₂ (%) vs. Time (minutes)

- SpO₂
- Pb

Sao Paulo (2086 m)
SL (1540 m)

Time (minutes): 61, 121, 181, 241, 301, 361
A patient with COPD

“Did you feel short of breath after your exercise?”

“Yes, of course! However no worse than I feel in the mornings rushing my shower!”
Individual SpO₂
<table>
<thead>
<tr>
<th></th>
<th>Sea Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO₂ (mmHg)</td>
<td>53</td>
</tr>
<tr>
<td>PaCO₂ (mmHg)</td>
<td>40</td>
</tr>
<tr>
<td>SaO₂ (%)</td>
<td>89.5</td>
</tr>
<tr>
<td>Hb (g.dL⁻¹)</td>
<td>14.7</td>
</tr>
</tbody>
</table>

(1) Grocott et al 2009
### Ton’s Blood Gas

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</tr>
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<td>PaCO₂ (mmHg)</td>
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<td>40</td>
</tr>
<tr>
<td>SaO₂ (%)</td>
<td>89.5</td>
<td>67.7</td>
</tr>
<tr>
<td>Hb (g.dL⁻¹)</td>
<td>14.7</td>
<td>15.5</td>
</tr>
</tbody>
</table>

(1) Grocott et al 2009
## Toni's Blood Gas

<table>
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<th>2086 m (rest)</th>
<th>2086 m (exercise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO₂ (mmHg)</td>
<td>53</td>
<td>35</td>
<td>29</td>
</tr>
<tr>
<td>PaCO₂ (mmHg)</td>
<td>40</td>
<td>40</td>
<td>40</td>
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<td>89.5</td>
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<td>14.7</td>
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<td>15.4</td>
</tr>
</tbody>
</table>

(1) Grocott et al 2009
Air Travel Hypoxemia vs the Hypoxia Inhalation Test in Passengers with COPD

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Kelly P, Swanney M, Seccombe L, Frampton C, Peters M and Beckert L. Air Travel Hypoxemia vs the Hypoxia Inhalation Test in Passengers with COPD. Chest 2008;133;1920-1926
Lung Disease, Oxygen Therapy and Air Travel

- Commercial aircraft cabin
- Organising tests and oxygen
- Medical Emergencies
Managing passengers with stable respiratory disease planning air travel

- 4 billion passengers / year
- Not many problems
- 17,000 calls to call centre
  - 10% respiratory issues
- Consider destination, not only flight
- Book extra services required
- Arrange medical insurance
- Ensure adequate supply of medication
- Obtain a doctors letter about usual illnesses.
- Consider booking an aisle seat and a seat near to the toilet
- Avoid alcohol and sedation
Managing passengers with stable respiratory disease planning air travel

- Assess patients with COPD.
- If Sat > 95%; they will be fine
- If Sat < 90%; they need oxygen
  - If Sat 90 – 95% they could be referred for a hypoxic challenge test.
- Air New Zealand and Quantas have better services than budget airlines.

- Bronchiectasis
- Cancer
- Heart failure
- Hypertension
- Airborne infections (departure hall!)
- HIV infections
- Obstructive sleep apnoea
- Pneumothorax
Please fit your own mask first before assisting others…. - … time to loss of consciousness.

- 40,000 feet (12,192 meters) - 15 seconds
- 35,000 feet (10,668 meters) - 20 seconds
- 30,000 feet (9,144 meters) - 30 seconds
- 28,000 feet (8,532 meters) - 1 minute
- 26,000 feet (7,925 meters) - 2 minutes
- 24,000 feet (7,315 meters) - 3 minutes
- 20,000 feet (6,096 meters) - 10 minutes
- 15,000 feet (4,572 meters) - Essentially indefinitely
Lung Disease, Oxygen Therapy and Air Travel

• Commercial aircraft cabin

• Organising tests and oxygen

• Medical Emergencies
Short – haul flight
Christchurch - Auckland

• Period of hypoxia is brief
  • 15 – 20 minutes
  • On hold in descent = sea leave conditions
  • Can walk on – will be alright
  • Use the bathroom before departure

• Pneumothorax (recent)
  • No travel – gas will expand

• No SCUBA diving within 24 hours
  • At risk of decompression illness
Long-haul flight
Auckland - Dubai

• Hypoxia longer duration, lesser magnitude
• Good exercise tolerance, Sats > 92%
  • No additional testing
• Impaired exercise tolerance, hypoxia at sea level
  • Consider altitude simulation test
  • Well tolerated hypoxia – discuss / reassure
  • Hypoxia and distress – Oxygen or don’t fly
• Don’t fly when unwell (flexible tickets)
• New aircraft (B787 / A350) little or no advantage
Lung Disease, Oxygen Therapy and Air Travel

• Commercial aircraft cabin

• Organising tests and oxygen

• Medical Emergencies
In summary, the study by Kelly and colleagues proves carefully obtained data which add to our understanding of pulse oximetry during commercial air travel. (Respirology)

Kelly and colleagues conducted an interesting and well-designed study that compared the results of the HAST with what actually occurred in COPD patients during commercial air travel. (CHEST)

Only through more research of this type published in this issue of CHEST will the HAST reach its full potential as the ‘gold standard’ for the evaluation of patients prior to commencing air travel. (CHEST)
Respiratory Physiology Research Group

- The role of FEV6 in spirometry
- Flight and altitude
- Patients accepting CPAP
- CPAP to prevent brain damage
- Lung clearance index
- Effects of Salbutamol on DLCO
- Salbutamol and breath alcohol
- Tracheal oxygen concentration
- Effect of inhaled corticosteroids on the voice
- SaO2 compared to SpO2
- Non-invasive lactate measurements
- Time interval between DLCO measurements
- Oxygen policies of airlines
- CPAP policies of airlines
- Effect of AIRVO on airway pressure
- Effect of AIRVO on tracheal temperature

PhD
PhD
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(PhD)
Masters
Masters
Masters
Masters
(Masters)
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Summer Student
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