Experiences and Knowledge regarding Intensive and Critical Care in Bolivia

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Surface: 1,098,581 km²
Population 10,027,254

LA PAZ 3244 - 4000
COCHABAMBA 2558
ORURO 3709
POTOSI 4070
BOLIVIA

PANDO 202
BENI 155
SANTA CRUZ 416
SUCRE 2790
TARIJA 1866
## Differences between Sea Level and Over Sea Level

### Table: Differences of Hemodynamic and Pulmonary Parameters Between Sea Level and Over Sea Level (3600 m)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>At sea level</th>
<th>Over sea level (3600 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCWP (mmHg)</td>
<td>N: 8 - 12 mmHg</td>
<td>PCWP (mmHg) N: 8 - 12 mmHg</td>
</tr>
<tr>
<td>CVP (mmHg)</td>
<td>N: 0 - 8 mmHg</td>
<td>CVP (mmHg) N: 0 - 8 mmHg</td>
</tr>
<tr>
<td>PaO2/FiO2</td>
<td>N: 400 - 500</td>
<td>PaO2/FiO2 N: 200 - 300 mmHg</td>
</tr>
<tr>
<td>EVLWI (ml/kg)</td>
<td>N: 3 - 7 ml/Kg</td>
<td>EVLWI (ml/kg) N: 3 - 10 ml/Kg</td>
</tr>
</tbody>
</table>

### Table: Physiologic Parameters at Sea Level and Over Sea Level (3600 m)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>At Sea Level</th>
<th>Over sea level (3600 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.40</td>
<td>7.40</td>
</tr>
<tr>
<td>PaO2 mmHg</td>
<td>90</td>
<td>60</td>
</tr>
<tr>
<td>PaCO2 mmHg</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>HCO3 mEq/l</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>SaO2 %</td>
<td>98</td>
<td>90</td>
</tr>
</tbody>
</table>

### Table: ALI and ARDS Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ALI</th>
<th>ARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO2/FiO2</td>
<td>&lt; 300 (&lt; 150)*</td>
<td>&lt; 200 (&lt; 100)*</td>
</tr>
<tr>
<td>Bilateral Infiltrates</td>
<td>si</td>
<td>si</td>
</tr>
<tr>
<td>PCP</td>
<td>&lt; 18 mmHg</td>
<td>&lt; 18 mmHg</td>
</tr>
</tbody>
</table>

*Poma, Sandi, PaO2/FiO2  Valor a 3600 m altura, Hospital Obrero, La Paz Bolivia, 2004*
Differences between Sea Level and Over Sea Level

<table>
<thead>
<tr>
<th>N (57)</th>
<th>Men n (20)</th>
<th>Women n (37)</th>
<th>N (57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMA VM</td>
<td>52, 53 cm/s +/- 7,83 (66 – 41)</td>
<td>52,85 cm/s +/- 8,27 (66 – 45)</td>
<td>52,25 cm/s +/- 7,40 (41 – 60)</td>
</tr>
<tr>
<td>CAA VM</td>
<td>39,8 cm/s +/- 6,37 (50 – 31)</td>
<td>40,28 cm/s +/- 6,87 (50 – 31)</td>
<td>39,37 cm/s +/- 5,3 (48 – 32)</td>
</tr>
<tr>
<td>CPA VM</td>
<td>40,87 cm/s +/- 6,37 (72 – 27)</td>
<td>40,17m/s +/- 6,87 (72 – 27)</td>
<td>41,37 cm/s +/- 5,3 (51 – 31)</td>
</tr>
<tr>
<td>BA VM</td>
<td>39,5 cm/s +/- 8,31 (29 – 65)</td>
<td>35,16 m/s +/- 3,87 (41 – 29)</td>
<td>45,37 cm/s +/- 12,34 (65 – 29)</td>
</tr>
</tbody>
</table>

MEDIA DE
Hto 49,56 +/- 4,40
Hb 16,46 +/- 1,45

R. Phillip Dellinger, MD; Mitchell M. Levy, MD; Andrew Rhodes, MB BS; Djillali Annane, MD; Herwig Gerlach, MD, PhD; Steven M. Opal, MD; Jonathan E. Sevransky, MD; Charles L. Sprung, MD; Ivor S. Douglas, MD; Romain Jaeschke, MD; Tiffany M. Osborn, MD, MPH; Mark E. Nunnally, MD; Sean R. Townsend, MD; Konrad Reinhart, MD; Ruth M. Kleinpell, PhD, RN-CS; Derek C. Angus, MD, MPH; Clifford S. Deutschman, MD, MS; Flavia R. Machado, MD, PhD; Gordon D. Rubenfeld, MD; Steven A. Webb, MB BS, PhD; Richard J. Beale, MB BS; Jean-Louis Vincent, MD, PhD; Rui Moreno, MD, PhD; and the Surviving Sepsis Campaign Guidelines Committee including the Pediatric Subgroup.

A. Initial Resuscitation

1. We recommend the protocolized, quantitative resuscitation of patients with sepsis-induced tissue hypoperfusion (defined in this document as hypotension persisting after initial fluid challenge or blood lactate concentration ≥ 4 mmol/L). This protocol should be initiated as soon as hypoperfusion is recognized and should not be delayed pending ICU admission. During the first 6 hrs of resuscitation, the goals of initial resuscitation of sepsis-induced hypoperfusion should include all of the following as a part of a treatment protocol (grade 1C):
   a) CVP 8–12 mm Hg
   b) MAP ≥ 65 mm Hg
   c) Urine output ≥ 0.5 mL·kg·hr
   d) Superior vena cava oxygenation saturation (ScvO₂) or mixed venous oxygen saturation (Svo₂) 70% or 65%, respectively.
Differences between Sea Level and Over Sea Level

Svc02  DEATH Vs. ALIVE

Media = 69.60

Death

Media = 75.23

Alive

Fuente. A. Avila Valores críticos altos o bajos de la Svc02 en la altura y mortalidad 1, 2007; 1-65.
Beginning of Critical and Intensive Care in Bolivia

- 1969
  First Intensive Care Unit was established in the National Thorax Institute

- 1979
  The first resident in this specialty arrived to Bolivia

  The Start of Critical and Intensive Care Medicine Society in the city of Cochabamba

- 1991
  Initiation of the First Critical and Intensive Care Medicine Residence in the City of La Paz
General Issues of the Bolivian Health System

- Is a segmented and disintegrated health system that lacks financing, planning and management.

- Possesses an Inadequate budget distribution, which causes an Insufficient provision of Infrastructure, equipment, supplies, and Medical and Paramedical staff.

- Has low resources:
  Health costs represent: 4.8% of GDP
  Health costs per capital during 2014: $174
  Comparison with neighboring countries
    - Uruguay: $1,431
    - Chile: $1,204
    - Brazil: $1,084
    - Argentina: $1,074
    - Paraguay: $395
    - Peru: $354

As a result, the quality of care and Patient Satisfaction has been deteriorated.
General Issues of the Bolivian Health System

- Insufficient number of beds in relation to population

- Insufficient CCM specialists: 98 Specialists in the Country

- Insufficient Nurses: According to World Health Organization
  1 Nurse for each 2 beds
  1 Nurse for each 2-4 beds

- General Maternal Mortality in Bolivia 180-223 / 100,000 born alive

- General Mortality in ICU: 22%

- Neuro Critical Care
  Lack of Technological equipment and knowledge to attend these patients
  Tissue plasminogen activator is not found in the National Drug List
  In La Paz, 7 out of 10 patients suffer ischemic Stroke
General Issues of the Bolivian Health System

• **Hemodinamic Care**
  Swan Ganz catheter is used until 2012

  Edwards (minimally invasive monitoring) is used from 2012

  Ultrasound in ICU from 2013

We do not have EV antihypertensives for example labetalol is NOT in the National Drug List

• **Infections**
  Absence of antibiotics because lack of support and interest from the Ministry of Health and Drug Industries

  For example *A. Baumanii* infections are only sensitive to Colistin (Colistin is not in the National Drug List)

• **Nutrition**
  We do not use indirect calorimetry

  There are no specific enteral nutrition formulas for diseases such as lung, kidney, liver, and hypercatabolics states.

• **Transplants**
  In Bolivia, the only transplants available are for Cornea and Kidney
Future of Critical and Intensive Care Medicine In Bolivia

• It will always be based on Anglo-Saxon studies.

• Telemedicine.
  There are few specialists in ICUs

• Future Contributions
  To the progress of Critical Care medicine in areas over sea level.

• Technology
  Projects to be able to adapt new technology to the country’s economy
What We as a Society Contribute to Improve Critical Care In Bolivia

- Continuous and repetitive Medical Education courses for specialists in our area
- Advice to the Health Ministry about Renal Health program, and implementation of ICUs in new hospitals of the Bolivian Government
- Training, development and specialization of nurses in Intensive Care
- Implementation of Care protocols according to the Bolivian reality
- General Medicine Studies in “Attention of serious illness” for MDs
- Nurse Studies in “Attention in Polytrauma patient care and medical emergencies”