Post-Polio-Syndrom

Dr. Joachim Weber
Chefarzt Innere Medizin
Ermstalklinik Bad Urach
1952: The Copenhagen Polio Epidemic and the Birth of Intensive Care

There are many reasons why people may end up on an intensive-care unit, most frequently following major operations, but also after head injury, septicaemia or respiratory failure from paralysis of the chest muscles. At any one time a patient can be hitched up to a dozen or more pieces of equipment: heart monitor, machines to measure the concentration of gases in the blood and the blood pressure, a pacemaker, a dialysis machine. It all looks, and is, so impressive that it can be difficult to appreciate that central to all this technological wizardry is just one piece of equipment, the ventilator blowing oxygen into the lungs. Oxygen alone ensures the heart carries on beating and "buys time" for tissues to heal and the complications of impaired body function to be attended to. The indispensable role of oxygen in human physiology has been known for the best part of 200 years, but the appreciation of its central role in the survival of the critically ill starts abruptly with the Copenhagen polio epidemic of 1952.
Eiserne Lunge
Geschichte und Entwicklung
Die Erfindung der Überdruckbeatmung

Björn Ibsen
Dänischer Anästhesist
Table 1. Blood pH and $P_{\text{CO}_2}$ values in a 5-yr-old boy after the onset of manual ventilation

<table>
<thead>
<tr>
<th>Hour</th>
<th>Blood</th>
<th>pH</th>
<th>$\text{PCO}_2$, mmHg</th>
<th>$\text{CO}_2$ conc, mmol</th>
<th>Bicarbonate, mmol</th>
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</thead>
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<td>32</td>
<td>24.4</td>
<td>24.5</td>
</tr>
<tr>
<td>3:05 PM</td>
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<td>14</td>
<td>15.6</td>
<td>15.2</td>
</tr>
<tr>
<td>Date</td>
<td>Hour</td>
<td>Blood</td>
<td>pH</td>
<td>PCO₂, mmHg</td>
<td></td>
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<td>------------</td>
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<td>7.49</td>
<td>32</td>
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<tr>
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<td>32</td>
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<tr>
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<td>36</td>
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<td>7.56</td>
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Blood pH and $P_{CO_2}$ values in a 30-yr-old woman during manual ventilation over 13 days.
Geschichte und Entwicklung
Atemphysiologie

- Ventilation
- Diffusion
- Zirkulation
- VO2
- VCO2
- V/Q-Match
**Thorax- und Zwerchfellatmung**

**Thorakale Atmung:**
Zug nach cranial erweitert den Thorax → Inspiration. Zug nach caudal verengt den Thorax → Expiration

**Abdominale Atmung:**
Abflachung des Zwerchfellserweiteret den intrathorakalen Raum → Inspiration
Einflüsse auf das Atemzentrum

Zentrale Antriebe

- Extracellulär-, Liquor-
  - H⁺
  - \( P_{\text{CO}_2} \)
  - pH

Höhere Zentren

- Schmerzreceptoren
- Körpertemperatur
- Hormone
- Thermoreceptoren (Haut)
- Pressoreceptoren
- Mechanoreceptoren

Chemoreceptoren
- \( P_{\text{O}_2} \)
- \( P_{\text{CO}_2} \)
- pH

Dehnungsreceptoren
Pathophysiologie der Ateminsuffizienz
Neurologische Erkrankungen
Pathophysiologie
Skeletterkrankungen
When Polio Strikes . . . Helpful Hints for Everyone

June through September is the season when infantile paralysis generally is on the upswing in the United States. The National Foundation for Infantile Paralysis has compiled the following suggestions which will be helpful to residents of areas where poliomyelitis is on the march.

1. During an outbreak of infantile paralysis be alert to any early signs of illness or changes in normal state of health, especially in children. Do not assume that a stomach upset with vomiting, constipation, diarrhea, severe headache or signs of a cold and fever are of no importance. These may be among the first symptoms of infantile paralysis. All children and adults sick with unexplained fever should be put to bed and isolated pending medical diagnosis.

2. Don't delay calling a physician. Expert medical care given early may prevent many of the crippling deformities. Proper care from the onset may mean the difference between a life of crippling and normal recovery.

3. Today there is no known prevention or protection against infantile paralysis. All that can be done is to provide the best possible care. Your doctor, your health officer and your local Chapter of The National Foundation for Infantile Paralysis can and will do everything in their power to see to it that your community is ready to meet an epidemic.

4. Observe these simple precautions:
   (a) Avoid overdriving and extreme fatigue from strenuous exercise.
   (b) Avoid sudden chilling such as would come from a plunge into extremely cold water on a very hot day.
   (c) Pay careful attention to personal cleanliness, such as thorough hand washing before eating. Hygienic habits should always be observed.
   (d) If possible avoid tonsil and adenoid operations during epidemics. Careful study has shown that such operations, when done during an epidemic, tend to increase the danger of contracting infantile paralysis in its most serious form.
   (e) Use the purest milk and water you can. Keep flies away from food. While the exact means of spread of the disease is not known, contaminated water and milk are always dangerous and flies have repeatedly been shown to carry the infantile paralysis virus.
   (f) Do not swim in polluted water.
   (g) Maintain community sanitation at a high level at all times.
   (b) Avoid all unnecessary contact with persons with any illness suspicious of infantile paralysis.

4. Don't become hysterical if cases do occur in your neighborhood. While infantile paralysis is communicable or catching during any outbreak, there are few who have such a slight infection that there are few or no symptoms. This large number of unrecognized infections is one of the reasons there is no practical way of preventing the spread of the disease. But it is also reassuring to know that, of the many persons who become infected, few develop serious illness and that, with good care, the majority who are stricken will make a satisfactory recovery. Remember that although this is a frightful disease, needless fear and panic only cause more trouble.

6. Attempts to stop the spread of the virus by closing places where people congregate have been uniformly unsuccessful. The resulting disturbance to community life is a disadvantage. Today there is no way by which the spread of infantile paralysis can be completely stopped.

7. There is no known cure for Infantile paralysis. Good medical care will prevent or correct some deformities. But it is about every fourth or fifth case there will be permanent paralysis that cannot be overcome. Do not believe those who say that a cure will cure these cases. Be guided by sound medical advice if polio does strike in your family.

8. In almost all the counties of the United States there are local Chapters of The National Foundation for Infantile Paralysis prepared to help health officers, doctors, nurses, hospitals and patients in every way possible. These Chapters stand ready to assist the entire community. Know your Chapter — ask its help if needed — and volunteer to help your Chapter so that it will be able to render the necessary services.
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<tr>
<th>Parameter</th>
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<td>pO₂ (37.0°)</td>
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<tr>
<td>Säure-Basen-Status</td>
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<tr>
<td>HCO₃⁻</td>
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</tr>
<tr>
<td>SB₃⁻</td>
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<td>tCO₂ (P)₃</td>
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<td>O₂Hb</td>
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<tr>
<td>RHB</td>
<td>36.5 %</td>
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</table>
Klinik Schillerhöhe  
Zentrum für Pneumologie und Thoraxchirurgie  
70839 Gerlingen

Atemantrieb

Identifikation:
Name:  
Vorname:  
Geburtsdatum:  
Geschlecht: 

Station:  
Überwachung: 

Schlaflabor

Alter: 73 Jahre
Bediener: Li

Datei __ BGA__
18.08.2003 14:52
Probe Nr. 7226

TEMPERATURKORRIGIERT

T°C: 37.0°C
pH: 7.403
pCO₂: 37.0°C: 35.5 mmHg
pO₂: 37.0°C: 66.3 mmHg

SAURE-BASEN-STATUS

HCO₃⁻: 23.9 mmol/L
SBE: 25.0 mmol/L
tCO₂: 56.0 vol %
ABl: 0.8 mmol/L
SB: 0.3 mmol/L

OXYMETRIE-ERGEBNIS

Hb: 15.6 g/dL
Hct: 47.0 %
Hct/Hb: 0.5 %
DpO₂: 52.1 %
O₂: 8.0 %

Blutgasdaten-Eingabe Ruhe-BGA

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<th>Zeit (min)</th>
<th>VTex 1</th>
<th>VTin 1</th>
<th>FECO₂ 1 %</th>
<th>V'CO₂ 1 ml/min</th>
<th>BF 1 l/min</th>
<th>V'K 1 l/min</th>
<th>PaCO₂ mmHg</th>
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<td>60.2</td>
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ΔΔAMV (60.2 - M,7) = 48.5 x 1000
ΔΔPO₂ (54.8 - 35.5) = 19.3
ΔΔPCO₂ = 2513 mmHg

Blutgasdaten-Eingabe Tsst-Bgs

<table>
<thead>
<tr>
<th>Zeit (min)</th>
<th>VTex 1 ml/min</th>
<th>VTin 1 ml/min</th>
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Hirnareale bei Dyspnoe durch CO2-Reiz

Überdruckbeatmung
Tracheostomie
Ansteigende Hyperkapnie unter O2-Therapie
Erschöpfung der metabolischen Kompensation
„Schwindsucht“ der Fettreserven und muskuläre Dekonditionierung
Zunehmende beeinträchtigende Adynamie und Tagesschläfrigkeit
Dekompensation des Cor pulmonale
Unterdruckbeatmung
Nicht-invasive Überdruck-Beatmung
Masken-Systeme
Geschichte und Entwicklung
Überdruckbeatmung
Volumen-Kontrolliert
Überdruckbeatmung
Druck-Kontrolliert
Abgestufte Palette an modernen NIV-Beatmungsgeräten
Moderne Geräte zur Invasiven Heimbeatmung
Sauerstoff-Therapie
Sekret-Problematik

Cough Assist
Probleme

- Akzeptanz durch Patient und dessen Umfeld
  - Grundlegende Bedürfnisse wie Essen, Trinken, Defäkation, Hygiene
  - Ermöglichung von Kommunikation
- Handhabarkeit auch durch „Laien“
- Verläßlichkeit und Robustheit
- Immanente Komplikationen
Was hat der Patient davon?

- Lebensqualität
- Lebensverlängerung
- Mehr Leistungsfähigkeit
Complications causing death

NIV bei ARI - hypoxämisch

Antonelli et al., JAMA 2000, 283:235

*N p = 0.05
Therapieerfolge