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AWARENESS OF OCCUPATIONAL EXPOSURE TO BERYLLIUM IN SARCOIDOSIS PATIENTS

Questionnaire study on Be exposure in sarcoidosis patients
Collaborators & Affiliation

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\end{itemize}
Advantages of Beryllium (Be) – Applications

• Beryllium alloys are sharing advantages of aluminum

• Copper-beryllium alloys (CuBe, CuCoBe) can hold off high temperatures and resist high mechanical stress

• Although very hard, the alloys are flexible, corrosion resistant, do not emit sparks and are not magnetic

• Addition of beryllium to alloys improves their benefits:
  – improves their electrical and thermal conductivity,
  – Improves the granularity and soothes surfaces,
  – Minimizes melting loss
  – Improves fluidness of the metal in casting processes
Disadvantages of beryllium use

Be, Be-oxid & Be-salts are harmful substances:

- irritative,
- sensitizing,
- may cause lung granulomas
- carcinogenic – (Kat. 1)

Lung diseases caused by Be:

- Acute Berylliosis (ARD-Syndrome)
- Chronic Berylliosis (granulomatous disease)
Origin of exposure to beryllium?

- Beryllium mines, extraction of beryllium (smelting and refining).
- Beryllium metallurgy (production of beryllium metal and compounds)
- Ceramic manufactures
- Rocket production
- Nuclear reactors
- Electronics, microcircuits, guidance and control systems, computer components, optics, jewelry...
- Recycling industry!
What health effects are associated with beryllium exposure?

• According to NIOSH (the National Institute for Occupational Safety and Health, 2011), "workers exposed to particles, fumes, mists and solutions from beryllium-containing materials may develop beryllium sensitization or chronic beryllium disease, a potentially disabling or even fatal respiratory disease."
Statistics on chronic beryllium disease (CBD)

- 1% - 20% of the exposed subjects are estimated to develop CBD (depending on the kind and intensity of the contact with Be, as well as the individual genetic susceptibility)


- Out of 536 patients diagnosed with sarcoidosis from 3 medical centers in 84 (15.7%), Be exposure was confirmed. 34 patients (40%) had a positive Be lymphocyte proliferation test (confirmation of sensitization to Be)

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Pathogenesis of beryllium disease

• **Acute:**
  – Skin damage (granuloma of the skin)
  – Sensitization of the skin
  – Acute lung disease (acute berylliosis, pneumonitis with lung edema)

• **Chronic:**
  – Allergic skin disease
  – Chronic beryllium disease (CBD)
  – Airway sensitization, granulomas (non-caseating)
  – Cancerogenesis (Category 1 MAK- & BAT-List)
Diagnosis

• **Clinic:**
  – Dry cough, expectoration, shortness of breath (on exertion); fatigue; weight loss; and loss of appetite

• **Lung function:** can be normal at the beginning (restriction)

• **Radiology:** chest X-ray & HRCT (can be normal at the beginning, a neg. result does not exclude CBD!)

• **Histology:** non-caseating granulomas, cellular interstitial changes

• **Immunology:** BeLPT (Be lymphocyte proliferation test - evidence of sensitization, not CBD!!)

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NON-CASEATING LUNG GRANULOMAS

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<table>
<thead>
<tr>
<th></th>
<th>SARCOIDOSIS</th>
<th>CBD</th>
</tr>
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<tbody>
<tr>
<td>Mechanism</td>
<td>Not known</td>
<td>Sensitization to Be (BeLPT) = 10x more often than BDS</td>
</tr>
<tr>
<td>Lung function</td>
<td>N -&gt; restriction, ↓ diffusion capacity</td>
<td>N -&gt; restriction, ↓ diffusion capacity</td>
</tr>
<tr>
<td>Radiology</td>
<td>Mediastinal (&amp; diffuse) Lymph nodes</td>
<td>Lymph nodes</td>
</tr>
<tr>
<td>Histology</td>
<td>Granuloma (95% non-caseating), BL : ↑ C4/C8</td>
<td>Granuloma non-caseating</td>
</tr>
<tr>
<td>Genetics</td>
<td>HLA II</td>
<td>HLA II marker</td>
</tr>
<tr>
<td>Systemic spreading</td>
<td>Systemic disease</td>
<td>Airways, skin, eyes, rarely multiorgan spreading</td>
</tr>
<tr>
<td>Therapy</td>
<td>2/3 spontaneous healing cortisone and immunosuppression</td>
<td>?? Cortisone</td>
</tr>
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The method of our questionnaire study

- Collecting of information on exposure to Be by questionnaire:
  - German version of the questionnaire of the Institut universitaire romand de Santé au Travail (ISI) – sent to sarcoidosis patients per mail

- In 250 Patients with clinically & histologically diagnosed sarcoidosis:
  - 95 (38%) patients (53 ♂ and 42 ♀; age 24-80 y) returned the questionnaire

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Inquiry on occupational or private exposure to Be

- Beryllium metallurgy
- Ship building, aircraft industry, activity in military service, nuclear reactors
- Mechanical fabrication
- Fabrication of optical instruments, watch or jewelry production
- Dental medicine
- Production in the field of electrics or electronics
- Waste recycling
Our results

- 4 (4.2%) of 95 sarcoidosis patients (of those who returned the questionnaire) were aware of a Be exposure.

- 47 (49.5%) of the sarcoidosis patients confirmed to have worked in occupations which could have been combined with beryllium exposure.

- 31 (32.7%) of sarcoidosis patients confirmed to have been exposed - at multiple workplaces, with a potential Be exposure.
Guidelines


Recommendations for occupational surveillance

• **Information on the risk** of Be and its harm to exposed workers - for the employer, employee and workers’ council

• **Workplace:** technical measures to **minimize exposure** – average shift exposure < 0.05 μg/m³ of inhalable Be (biomonitoring: Be in urine – risk management efficacy)

• Airway symptoms & if ↓ LF -> DDg. Of CBD considered!

• BeLPT 2 x pos. -> periodic (1-3 years) **radiologic controls**

• Be sensitized and CBD patients – **regular surveillance**, to prevent the onset or considerable deterioration of CBD
THANK YOU FOR YOUR ATTENTION!!