PHOSSY JAWS
An Old Occupational Disease – Up to Date?

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A Historical and Medical Review

Background: recently described necrosis of jawbones associated with a bisphosphonate therapy

Donald Hunter: „the greatest tragedy in the whole story of occupational disease“

Chemical Characteristics of Phosphorus

1674 described by Henning Brandt (Hamburg / Germany), three allotropic modifications

- white (yellow) P.: very toxic, self-inflammable
- red P.: less toxic, generated by heating white Phosphorus in a vacuum
- black P.: similar to red P.

History

- First matchsticks were called Tankhölzer (moistened with sulphuric acid).
- 1832: J. Siegel (Austria) and C. Kammerer (Germany) contrive at the same time a matchstick with a had made of white Phosphorus.
- Since 1833 matchstick factories and many manufactories in all European countries arise.
- 1839: first necrosis of the lower jaw (phossy jaw [pj]) seen and reported in Germany.
- 1844: F. Lorinser reports about 5 cases of phossy jaws of young women, working in the match industry.
- 1845: A. Oberhofer (Vienna) and J.F. Heyfleder (Erlangen) point out phosphorus as the causing agent of pj.
- 1866-1875: 126 cases of pj in Vienna’s hospitals are reported.
- 1896-1906: 400 new cases in Austria.
- Match factories: Mostly children, adolescents and women. Phosphoric vapor is generated by heating up phosphoric compounds, also absorbed through the gastro-intestinal tract; daily working hours 16 h!
- After discovery of red phosphorus, successive prohibition of white phosphorus throughout the match industry.
- 1872 Finland, … 1907 Germany, …1912 Austria, …1931 United States.

Pathophysiology / Toxicology

- Phosphorus, a strong reducing agent, inhibits the intracellular oxidation process, so acting as a cell-toxin.
- Uptake through aerosols, via GIT (suicide) and dermal absorption.
- Acute: Skin ulcers, irritation of mucus membranes, suffocation-attacks, coma, death; symptom free interval (6-48 h), followed by vomiting, cephalgia, enteralgia, hematochezia, fever, kidney failure and yellow atrophy of the liver.
- Chronic: unspecific GL-disorders, anemia, bleeding tendency, weight loss, kidney damage, muscle weakness, periostal thickening and osteoporosis (even years after the exposure has been terminated).

Phossy Jaws

- Only caused by elementary phosphorus.
- Mostly years after exposure (7-15 years).
- Nutritional disorder of the osteoclasts, due to endothelial damage (thrombosis and consecutive obliteration) of the bone’s blood vessels.
- Bone apopostion, followed by osteoporosis.
- Successive disorder of the immune system, periostitis and osteomyelitis.
- Via caries, injuries of the oral mucous membrane, after tooth extraction: Bacteria penetrate the jaw.
- Clinical signs are: Extremely painful osteomyelitis of the jaw bone.
- Mandible more often affected than maxilla (lower perfusion of the mandible, resulting in a lower resistance to infection).
- Pyosis, abscess formation, necrosis, sequester and sinus formation.
- Destruction of the jaw bone; therefore, disfiguring illness.
- Complications: septiciaemia, pyrogenic meningitis, destruction of the eye bulbus; Lethality formerly up to 40%.

Therapy and Prophylaxis

- Surgical removal (sequestrectomy, possibly spongiosa plastic, graft), antibiotic treatment, (cholecalciferol, calcium, hyperbaric oxygen therapy).
- Dental reconstruction, regular dental check-ups.

Literature