The Rise and Fall of Chronic Solvent-induced Encephalopathy in NL and Finland

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ANTALYA, MARCH 2019
Chronic Solvent-induced Encephalopathy (CSE), from recognition towards prevention

How the ‘Danish Painters Disease’ got recognised:
- History of CSE in Finland and The Netherlands
- Some figures from Finland and The Netherlands
- International collaboration/research
- Exporting dirty jobs + diseases
  - ‘Unhealthy work in a globalized economy’

CSE: mild cognitive impairment after long-term exposure to organic solvents

1) impairment of memory and other cognitive functions (abstraction, thinking, planning, etc).
2) impaired emotional control and motivation, eg. emotional lability, irritability, initiative and energy
Historical background Finland

- Start of human neurotox research in 1966 (Helena Hanninen)
  - 25 occupational chemical exposures studied (+ solvents, welding fumes, pesticides) mostly cross-sectional studies (exposed vs. control)
  - These served the important function of identifying chemicals with neurotoxic potential and in need of further examination.
- Clinical cases recognized by Finnish Institute of Occupational Health (FIOH) since 1980.
Historical Background in NL

- **1985-1995** Growing awareness in NL about the long term health effects of solvent exposure.
  - Victims of ‘Painters disease’ in media
  - Patient organisation, Unions, Members of Parliament ask for special focus on chronic solvent induced encephalopathy
- **1995** Protocol diagnostic procedure (Min.Labour)
- **1997** Funding Solvent Team project (Min.Health)
- **2000** Legislation:
  - ban on the use of solvent based paints indoor
  - ban on the use of solvent based glues for floor layers indoor
  - agreements for lowering exposure in paint and ink-manufacturing, car-spraying etc.
Toxic encephalopathy: acute and chronic organic mental disorders

Roberta F White, Susan P Proctor Solvents and neurotoxicity
*The Lancet, Volume 349, Issue 9060, 1997, Pages 1239-1243*

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Duration</th>
<th>Symptoms</th>
<th>Residua</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute intoxication</td>
<td>minutes to hours</td>
<td>CNS depression, psychomotor or attentional deficits</td>
<td>none</td>
</tr>
<tr>
<td>Acute toxic encephalopathy</td>
<td>minutes to hours</td>
<td>confusion, coma, seizures (cerebral oedema, CNS capillary damage, hypoxia)</td>
<td>permanent cognitive deficit may occur</td>
</tr>
<tr>
<td>Organic affective Syndrome</td>
<td>days to weeks</td>
<td>mood disturbance (depression, syndrome irritability, fatigue, anxiety)</td>
<td>none</td>
</tr>
<tr>
<td>Mild chronic toxic encephalopathy</td>
<td>years</td>
<td>fatigue, mood disturbance, cognitive complaints</td>
<td>improvement may occur in absence of exposure but permanent mild cognitive deficits can be seen</td>
</tr>
<tr>
<td>Severe chronic toxic encephalopathy</td>
<td>years</td>
<td>severe cognitive and affective change interfering with daily living Neurological deficits: abnormalities seen on some neurophysiological or neuroradiological measures (CT, MRI, EMG, EEG)</td>
<td>permanent cognitive dysfunction</td>
</tr>
</tbody>
</table>
Assessment of cases of possible CSE: 5-step multidisciplinary approach

- Consideration of evidence of disease:
  - medical and neuropsychological assessment

- Consideration of toxicological and epidemiological data

- Consideration of evidence of exposure
  - Occupational history; comparison with worksituations with known exposure. Exposure assessment: # solvent years. In the patient group mean exposure: 23 years daily exposure to solvents

- Consideration of other relevant factors
  - Differential diagnostic issues

- Evaluation and conclusion
  (suggestions for prevention)
Retrospective exposure assessment
‘the art of taking an occupational history’

- Workers know best; ask them to get better insight:
  - Homework: life long occ. history
  - Drawings, photograph’s

- Doctor’s knowledge of jobs helps
  - Targeted information

- Ask the right questions:
  - [x] Do you work in a dusty environment?
  - [x] What tool makes the dust?

Paint stripper
Methylene Chloride
CSE: differential diagnostic issues

- Major depression
- Sleep disorders
- Neurodegenerative disorders: Alzheimer’s disease, Parkinson’s disease
- Neurovascular disorders
- Neoplasmas: brain tumors, paraneoplastic symptoms
- Metabolic causes: avitaminosis, thyroid disorders
- Other toxic encephalopathies: alcohol, drugs, lead, mercury
- Traumatic brain disorders
Patients referred and number of CSE-cases in The Netherlands 1997-2017
Referred and diagnosed toxic encephalopathies (=CSE cases) in Finland during 1995-2007

The line: yearly CSE cases at FIOH during 1995-2007 (n=129).
The columns: yearly referred cases at FIOH during 1995-2005 (n=425), of which the proportion of CSE cases (black segment) declined from 38% in 1995-1999 to 15% in 2000-2005

Keski-Säntti et al 2010
© Finnish Institute of Occupational Health - www.ttl.fi
### Occupations of CSE-patients in NL (1997-2007):

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painter</td>
<td>152</td>
</tr>
<tr>
<td>Paint sprayer</td>
<td>81</td>
</tr>
<tr>
<td>Printer</td>
<td>47</td>
</tr>
<tr>
<td>Upholster</td>
<td>19</td>
</tr>
<tr>
<td>Production of paint/ink</td>
<td>12</td>
</tr>
<tr>
<td>Floor layer</td>
<td>4</td>
</tr>
<tr>
<td>Production/transport chemical industry</td>
<td>7</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>74</td>
</tr>
<tr>
<td><strong>Totaal</strong></td>
<td><strong>396</strong></td>
</tr>
</tbody>
</table>
Miscellaneous Occupations CSE:

- Artificial nail worker (Aceton + mixture)
- Fine arts painter
- Shoe gluing (n-hexene)
- Dry-cleaning workers (Perchloroethylene)
A barrier for recognition

- Neuropsychological testing is one of the cornerstones of the diagnostic procedure.
- That explains that ‘painters encephalopathy’ is considered as a ‘pseudoneurotoxic disease’ by some scientists and physicians. There is reluctance to embrace psychological methods in occupational health.

*Medical History, 2006, 50: 167–188

Watching Paint Dry: Organic Solvent Syndrome in late-Twentieth-Century Britain

ANNE SPURGEON*
1.1.38. Diseases caused by organic solvents

135 Encephalopathies due to organic solvents which do not come under other headings

Under Annex 1; in 1990 Annex 2
Research and international collaboration

- Spinn-off of the Solvent Team project
  - Diagnostic methods
    - Neuroimaging
    - Decision rules
  - Individual susceptibility?
  - Underperformance
  - Rehabilitation
- European consensus project on neuropsychological assessment
Chronic Solvent induced Encephalopathy: A step forward
Gert van der Laan, Markku Sainio
Netherlands Center of Occupational Diseases, Coronel Institute, University of Amsterdam and Finnish Institute of Occupational Health (FIOH), Netherlands

Chronic solvent-induced encephalopathy: European consensus of neuropsychological characteristics, assessment, and guidelines for diagnostics
Evelien van Valen, Christoph van Thriel, Ritva Akila, Linda Nordling Nilson, Rita Best-Pettersen, Markku Sainio, Frank van Dijk, Gert van der Laan, Maarten Verberk, Ellie Wekking

Decision rules for assessment of chronic solvent-induced encephalopathy: Results in 2370 patients
Vlaarten M. Verberk, Joffrey A.F. van der Hoek, Evelien van Valen, Ellie M. Wekking, Moniek S.E. van Hout, Gerard Hageman, Gert van der Laan, Frank J.H. van Dijk
Pitfalls in clinical assessment of neurotoxic diseases: Negative effects of repeated diagnostic evaluation, illustrated by a clinical case

Moniek van Hout, Gerard Hageman, Evelien van Valen
Diseases caused by organic solvents worldwide?

– Shift of 3-D type of job: Dirty, Dangerous, Demanding from industrialized countries into developing countries.

KOSHA: Cluster of cases in S. Korea
Recognition of CSE; key elements:

- Visibility of victims
- Convincing Case-reports
- Victims organizations / Union support / active scientists, MD’s
- Epidemiological studies
- Scientific recognition (Lancet article)
- Diagnostic methods/ facilities
- Political national and international recognition (ILO / EU list OD)
Conclusions:

- Solvent Neurotoxicity can be controlled
- Visibility of victims helps in recognition and to accelerate preventive measures
- Multidisciplinary Solvent Team program approach is successful:
  - Quality improvement
  - Contribution to prevention
- International collaboration is essential (especially in rare occupational diseases)
- Beware of exporting occupational hazards
Thanks for your Attention

g.vanderlaan@occmmed.eu
Reduced D2 striatal receptor density in:

- CSE \((p<0.001)\)
- Healthy exposed controls \((p<0.001)\)