THE IMPLICATIONS OF HAZARDOUS WASTE NEUTRALIZATION ON EMPLOYEES HEALTH: A CASE STUDY

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THE IMPLICATIONS OF HAZARDOUS WASTE NEUTRALIZATION ON EMPLOYEES HEALTH: A CASE STUDY (Abstract): Chronic obstructive pulmonary disease is a lung disorder characterized by chronic inflammation of the respiratory tract after exposure to pollutants, causing the obstruction of small respiratory tracts and the destruction of lung parenchyma. These changes ultimately lead to a limitation of air flux. We investigate the association between professional exposure and the risk of developing chronic obstructive pulmonary disease. This study presents the case of a non-smoker patient, aged 61, a mechanic locksmith by profession at a hospital in Mures County. He has been working with neutralization of medical waste for 13 years with exposure to pneumotropic and biological contaminants and to the overuse of osteoarticular apparatus, recently having been diagnosed with COPD after exposure to mixed powders and hospitalized at the occupational health clinic. Interruption of occupational exposure and establishment of treatment with topical corticotherapy has shown a significant improvement. Measurements of inhalable powder content in the work environment revealed that they exceed the allowed limit in case of neutralization of medical waste and there is an association between occupational exposure and increased risk of chronic obstructive pulmonary disease. Preventive methods should aim to reduce exposure at workplace. Keywords: COPD, POLLUTANTS, SPIROMETRY

Medical wastes are hazardous both for people and for the environment, exposing people to the risks of toxic infections. These types of waste result from all the medical activities in the national health system (1). Persistent Organic Pollutants (POPs) are chemicals which are particularly harmful to human health and the environment. They have been the subject of several environmental policies, and the subject of an International Convention (7). The Stockholm Convention on POPs has taken into consideration 12 categories of pollutants and has noted the obligation of each part to elaborate a National Plan for the Implementation of the provisions of the above mentioned Convention (9). These 12 priority POPs are aldrin, chlordane, dichloro-diphenyl-trichlorethan (DDT), dieldrin, heptachlor, myrex, endrin, toxaphen, poly-
chlorinated biphenyls (PCBs), dioxins and furans, hexa-chloro-benzene (2).

The Stockholm Convention, adopted in 2001, is the one which regulates the scrapping of POPs on a worldwide scale (3,4). In addition to tobacco smoking the exposure to pollutants at the workplace (dusts, fumes, and irritating gases) is a major risk factor for chronic obstructive bronchial pneumopathy (5,6).

**CASE REPORT**

In this paper we present the case of MF, a 61-year-old non-smoker, a professional locksmith mechanic, with approximately 40 years of professional service. From his professional route we would like to highlight the past 13 years, when the patient worked as a mechanical locksmith in a hospital in Mures County, in the last 3 years carrying out his activity in the department of medical waste neutralization. The patient participated in all the stages of neutralizing waste, involving: loading the autoclave with the medical waste collected from different wards of the hospital, automatic and manual ventilation, extraction of sterilized medical waste transported on conveyors up to grinding, ripping with a shovel, loading and storage of waste in the form of powders in crates and then loading them into bags as well as the transport towards the container. The patient therefore has currently been exposed professionally to the biological contamination, infections in hospitals that come from the neutralization of materials disposable sanitary remains, pneumototropic fumes arising from the ventilation of the autoclave, metal powders, plastics and textiles from the process of chopping, overuse of the osteo articular apparatus by removal of weights and repetitive harmful movements and positions as well as an unfavourable microclimate.

The patient complains of shortness of breath at the moment of hospitalization, in especially upon exertion, predominantly dry cough. The symptoms first appeared 2 years ago, the period coinciding with the professional activity in the neutralization station. He complains of pain in coxofemoral joints, lumbar spine pain, and persistent bilateral pain in the lower limbs. The patient had accidental exposure to HIV (Human Immuno-deficiency Virus) and hepatic viruses, for which he sought treatment with antiretroviral drugs in 2010 as a means of prevention; for the osteoarticular problems he was admitted to the clinic of Rheumatology in 2013, and for pulmonary disease to the clinic of Pneumology. He was diagnosed with chronic obstructive bronchial pneumonitis stage I/II, interstitial reticulonodular pulmonary fibrosis, for these conditions treatment with slight improvement in symptomatology was followed. Occupational health surveillance is recommended and hospitalization for occupational diagnosis is needed. The patient is hospitalized in May 2013 at the Occupational Health Clinic of Târgu-Mureş. The general clinical examination revealed osteoarticular affections and a pulmonary disease. The thoracic radiography describes a chronic bronchitis with pulmonary emphysema.

The spirometry (tab. I) carried out two years ago in a periodical medical control at work shows a mixed average ventilation dysfunction FEV1 (Forced Expiratory Volume in 1st second) at 60%. FEV1 at the moment of hospitalization shows an increase of 72 percent. Therefore, the patient is being treated in conformity with treatment recommended by the Clinic of Pneumology, and 3 months after the suspension of the activity, the value of FEV1 increased
to 84%.

The bronchodilation test was also performed (tab. II) for differential diagnosis between fixed obstruction, namely chronic obstructive pulmonary disease and the reversible obstruction of the respiratory tract, namely bronchial asthma. The test is negative, meaning that the obstruction is fixed.

The body-plethysmography (tab. III) shows an increased resistance of the respiratory tract.

In conformity with the anamnesis, clinical and paraclinical examinations the following diagnoses were established: (i) chronic obstructive bronchopneumopathy, stage I/II due to exposure to mixed powders (metal, plastics, textile) and vapors; (ii) mild mixed ventilation dysfunction with the dominance of restriction; (iii) lumbar polydiscopathy of professional etiology; (iv) cervical spondylosis and vertebrobasilar insufficiency.

During hospitalization the patient followed treatment for the above mentioned diagnosis with a favorable evolution of his general state. It is recommended to avoid overloading the osteoarticular apparatus and harmful positions, wearing protective masks in the workplace, ensuring natural ventilation.

Determinations were performed from the work environment (tab. IV) measuring the total dust in suspension in the medical waste neutralization area, in the waste removal hydroclave and their placement in the chopper. Here the powder is in normal range, below 1 mg/m³ on 8 hours and at the loading of powder in bags it is 1.39 mg/m³, above the maximum concentration, i.e. more than 1 mg/m³.

### TABLE I

**Spyrometry**

<table>
<thead>
<tr>
<th>Spyrometry</th>
<th>FVC (%)</th>
<th>FEV1 (%)</th>
<th>Tiffeneau index (%)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical medical control</td>
<td>50</td>
<td>60</td>
<td>85</td>
<td>Medium mixed ventilation dysfunction</td>
</tr>
<tr>
<td>Occupational Health Clinic</td>
<td>66</td>
<td>72</td>
<td>80</td>
<td>Mild mixed ventilation dysfunction</td>
</tr>
<tr>
<td>3 months after the suspension of activity</td>
<td>71</td>
<td>84</td>
<td>92</td>
<td>Mild restrictive ventilation dysfunction</td>
</tr>
</tbody>
</table>

FVC-forced vital capacity  
FEV1-forced expiratory volume in 1 second  
Tiffeneau index –FEV1/FVC ratio

### TABLE II

**Test of bronchial dilatation**

<table>
<thead>
<tr>
<th>Test of bronchial dilatation</th>
<th>FEV1 (%)</th>
<th>FVC (%)</th>
<th>Tiffeneau index (%)</th>
<th>PEF (%)</th>
<th>MEF50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>72</td>
<td>66</td>
<td>80</td>
<td>79</td>
<td>96</td>
</tr>
<tr>
<td>After the administration of Ventolin</td>
<td>76</td>
<td>61</td>
<td>91</td>
<td>93</td>
<td>116</td>
</tr>
</tbody>
</table>

PEF- Peak Expiratory Flow  
MEF50%- Maximal Expiratory Flow at 50%
The implications of hazardous waste neutralization on employees health: a case study

### TABLE III

<table>
<thead>
<tr>
<th>Body-Pletismography</th>
<th>Raw</th>
<th>Gaw</th>
<th>TLC</th>
<th>VR</th>
<th>TLCO</th>
<th>DLCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>155</td>
<td>175</td>
<td>73</td>
<td>59</td>
<td>119</td>
<td>119</td>
</tr>
</tbody>
</table>

Raw- specific airway resistance; Gaw- reciprocal of airway resistance; TLC- total lung capacity; VR- residual volume; TLCO-transfer factor; DLCO- diffusing capacity for carbon monoxide

### TABLE IV

**Determinations of the work environment**

<table>
<thead>
<tr>
<th>Medical waste neutralization department</th>
<th>Chemical agent</th>
<th>Result (mg/m³)</th>
<th>Maximal admissible concentration on 8 hours (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of sterilized waste from the hydroclave and loading it into the grinder</td>
<td>Powder- inhalable fraction</td>
<td>0.465</td>
<td>1</td>
</tr>
<tr>
<td>Loading the powder in waste bags</td>
<td>Powder- inhalable fraction</td>
<td>1.39</td>
<td>1</td>
</tr>
</tbody>
</table>

### CONCLUSIONS

Dust concentration measured at the work site exceeds maximal admissible concentration with 0.39 mg/m³. These values do not greatly exceed the maximal admissible concentration. However they have a significant impact on the health status of employees engaged in the process of medical waste neutralization. The medical waste neutralization procedure reduces the risk of environmental pollution, but does not eliminate the risk of diseases among employees.

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