CASE REPORTS AAEM

Ann Agric Environ Med 2000, 7, 51–53

HEAVY METAL POISONING IN GLASS WORKER CHARACTERISED BY SEVERE DENTAL CHANGES

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Bachanek T, Starosławska E, Wolańska E, Jarmolińska K: Heavy metal poisoning in glass worker characterised by severe. *Ann Agric Environ Med* 2000, **7**, 51–53.

Abstract: The paper presents the clinical description of the masticatory organ and biochemical assessment of dental tissue in a patient employed in a glassworks for 20 years. During 12 years the patient has suffered baldness ("Alopecia areata") and atypical extensive and non-healing cutaneous lesions. Dental examination revealed changes typical of chronic poisoning by cadmium and bismuth compounds.

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Key words: dentinal tissues, heavy metal poisoning, cadmium, lead, bismuth, thallium.

INTRODUCTION

The increasing pollution with many heavy metals harmful for the teeth of the living organisms has been the subject of considerable interest [1-20]. The development of the industry and expansion of the chemical compounds used in different branches of industry are leading to the environmental spread of heavy metals as thallium, lead, cadmium and bismuth, among others.

Toxic substances emitted into the air change quantitative relations among elements occurring in the environment, as well as in the human body. Many workers are exposed to heavy metals in industry, particularly in the metal finishing industry or traditional glassworks.

Thallium, cadmium, bismuth, and lead cause morphological and functional changes in the human body. The clinical course of such changes is determined by the amount of the heavy metal dose, duration of exposure to the toxic metal, and individual immunity of the patient [17].

CASE DESCRIPTION

Medical history. The report presents the case history and current condition of the patient exposed to the long-term effects of heavy metal compounds. The 66-year-old male patient A.M. had worked for 20 years as a repairer in the glassworks. He was in contact with all the chemical substances involved in the technological process of glass production and treatment. After 20 years of work, his first symptoms were hair loss all over the body, psoriasic, itching spots, and trophic ulcerations on thighs and dorsa of the feet. The spot bases developed hard to heal ulceration which left astringent scars after treatment. A year after the onset of the lesions the patient had 18 teeth extracted during 13 months. The teeth were qualified for extraction due to their attrition and crown fractures. The crowns revealed unusual hard tissue brittleness and dark brown shade. The histopathological examinations of the skin and subcutaneous tissue lesions disclosed non-

Received: 20 December 1999
Accepted: 8 May 2000

Table 1. Thallium, bismuth, lead and cadmium contents (ppm) in hard tissues of the patient's tooth and control teeth.

Elements	Hard tissue metal content of the patient's tooth (ppm)	Hard tissue average metal content of control teeth (ppm) n = 6
Thallium	3.00	< 0.010
Bismuth	50.10	< 0.030
Lead	14.00	1.78
Cadmium	1.40	0.054

specific inflammatory infiltration of hair follicles, epidermal trophic disturbances. The diagnosis of heavy metal poisoning was established [12, 13, 16, 17]. Since 1991, the patient was treated in the Surgical Division of District Hospital in Krosno (card number 9255/91) and in 1996 was hospitalised in Conservative Dentistry Clinic of Medical Academy in Lublin.

Clinical Examination. The extra- and intraoral dental examinations showed: complete hair loss on head skin, extensive, astringent scars and inflammatory ulcerations of variable sizes; trigeminal nerve openings were insensitive to pain, lymph nodes impalpable. Numerous tiny, black deposit spots typical for chronic bismuth poisoning were observed on the buccal and lower lip mucosa. Two teeth (34, 43) with dark orange colour change, but no carious defects were found. The darkened teeth in the region of the exposed necks were suggestive of the presence of cadmium line. The inflammatory changes were observed in the marginal gingival tissue. The 34th tooth showed the II° loosening. Considering low usefulness in chewing, the tooth was extracted and the biochemical analysis was performed.

Biochemical examination. The contents of the heavy metals: thallium, lead, cadmium and bismuth, in the patient and control teeth were determined using atomic absorption spectrometry. All the samples were analysed in Analytical Laboratory, Faculty of Chemistry, Marie Curie-Skłodowska University in Lublin. The solid sampling graphite furnace technique was applied for the analysis. Used analytical procedure was a modification of that described in the literature [1, 6, 14, 20]. The results were compared with the average contents of thallium, lead, cadmium and bismuth in the hard tissue of 6 teeth (control group) of four patients living in regions distant from the residence of the patient examined. The age of the four patients from the control group was between 58 and 69. Results of the analysis are presented in Table 1.

DISCUSSION

The results shown in Table 1 clearly indicate that patient A.M. was highly intoxicated by heavy metals. The normal concentration of heavy metals in human teeth depends on the place of residence and type of industry located nearby. The average concentration of the considered heavy metals is usually much below 1 ppm, and in many cases is not detectable by atomic absorption spectrometry.

The concentration of thallium in the patient's tooth was 300 times higher than in the control teeth. Thallium poisoning was also proved by complete hair loss all over the patient's body, trophic skin changes, pneumonia and microcirculatory disorders delaying proper healing process.

Lead poisoning resulted in colic attacks. Concentration of lead was about 7 times higher than normal.

Cadmium and bismuth excess (30 and 180 times higher than in the control group) led to cadmium line symptoms on tooth crowns and bismuth deposit spots within the lower lip mucosa.

We have to emphasize that it was impossible to find additional material for this study, as other persons who had worked with the patient over a long period (in the same environment) are no longer alive. They died suddenly in the early eighties, without proper clinical examination, but according to the patient from heart attack. Our patient's relatively good present health condition can only be explained by the enormous immunity of his organism.

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