JURNAL DE MEDICINĂ PREWVENTIVĂ
2001; 9(1); 32-34

ZIRCONIUM PNEUMOCONIOSIS (Zr)

Marilena Petran[1], Liana Olinici[2], A. Cocârlă[1], M. Băiescu[2], L. Tefas[1], C. Dumitru[2]

1. University of Medicine and Pharmacy "Iuliu Haţieganu" Cluj-Napoca, Department of Occupational Health; 2. Hospital of Occupational Medicine Cluj-Napoca

Abstract. The authors describe an interstitial pulmonary fibrosis to a female professionally exposed to zirconium pigments employed in a pottery product factory. Due to the pulmonary radiographic and CT aspects, as well to the absence of other causes generating pulmonary fibrosis there is a suspicion of zirconium pneumoconiosis.
Key words: zirconium, pneumoconiosis, occupational exposure

Rezumat: Autorii descriu un caz de fibroză pulmonară interstiţială la o femeie expusă profesional la pigmenţi pe bază de zirconiu într-o fabrică de produse ceramice. Datorită aspectului radiografic pulmonar standard, al CT, precum şi prin absenţa altor cauze generatoare de fibroză se ridică suspiciunea unei pneumoconioze la zirconiu.
Cuvinte cheie: zirconiu, pneumoconioză, expunere profesională

The existence of pathological aspects that can be revealed by radiological and functional tests, in workers occupationally exposed to zirconium was only presumed up to the nineties.

The extend of zirconium use in different industries, especially in the top ones (e.g.: jet propulsion) and the elapse of a sufficient exposure period to induce effects, describe the occupational circumstances in which the pulmonary fibrosis to zirconium and the accompanying functional changes have been frequently approached in the last years. As a consequence, zirconium pneumoconiosis, although dealt with different names, became an undeniable nosology.

The few reported cases published by medical literature on one hand, and the increased number of the exposed people together with the technological upgrade in Romania on the other hand, justify the rise for discussion a clinical case, in order to stimulate the interest for the occupational diagnosis of some lung disease of the interstitial fibrosis type.

Case raport:

Patient L.A., 45, female, was admitted in the Hospital of Occupational Medicine for asthenia, dyspnea at medium effort, occasional wheezing and dry cough. The most important findings of patient history were the repeated upperairways infections and a 25 years period of cigarette smoking (7-10 daily cigarettes).

The occupational history data indicated a 28 years exposure to zirconium-based pigments in a pottery manufacture.

The insidious disease onset was 8 years ago, with a dyspnea which became intensely during physical

efforts (well tolerated before) and dry cough appearing to cold exposure, frequently associated with wheezing.

The laboratory investigations and EKG were normal, allergy tests did not reveal a positive reaction to dermatophagoides, but the pulmonary function testing revealed a severe obstructive ventilatory dysfunction on the small airways with severe hyperinflation: VC:2750 ml (100%); FEV_1: 1630 ml (69%); MEF_{50}:1 l/s (26%); RV:2990 ml (203%).

After β2-agonists and inhaled cortizone treatment, the static and dynamic lung volumes and capacities were recovered: VC:3030 ml (+10%); FEV_1: 2040 ml (+24%); MEF_{50}:1,53 l/s (+52%); RV:2920 ml (-5%).

The dynamics of the ventilatory tests revealed a varying obstructive syndrome, and a bronchial hyper responsiveness both characteristic features for bronchial asthma in an atopic subjects.

A conventional chest X-ray imposed by the background dyspnea showed bilateral small reticular nodules in the middle pulmonary areas. Because of suspected diagnosis of zirconium pneumoconiosis as well as patient's refuse of lung biopsy, a computed tomography was performed.

Fig. 1 shows the images which revealed a diffuse interstitial fibrosis.

Figura 1: CT image at patient L.A.

The pathological changes induced by occupational exposure to zirconium were quite well outlined by the research performed in the last 10 years. The main occupational risk circumstances are the drying and calcination of the concentrates containing zirconium, the use of its compounds for poterry glazzing refractaries, glass industry, TV display tubes and jet propulsion engines.

Granulomatous skin lesions, have been found in occupational exposure to zirconium. The same lesions have been also described following the non occupational exposures such as, the use of antiperspirant cosmetic products, or those appeared in some

Ethiopian areas described as non philariosic pneumoconiosis.

According to the evolutionarily stage of lesions, the lung involvment appeared firstly as an interstitial granulomatosis then followed by a fibrous proliferation, features which place it among pneumoconiosis.

There is a similarity between the histological aspects of skin lesions and the pulmonary ones, and some authors found granulomatous lesions in many organs.

The occupational origin of the pulmonary granulomatosis is demonstrated by the presence of birefringent zirconium silicate crystals in optical microscopy slides or in bronchoalveolar lavage sediment examined by means of electronic microscopy.

Experimental research confirmed clinical observation; following zirconium compounds administration to laboratory animals granulomatous interstitial and skin lesions, were found.

The radiological aspect described by Cazzadori, respectively the presence of reticulate-interstitial opacities, is similar with our case.

As diagnosis, this reported case is still a probability because of the lack of morphological or mineralogical confirmation. But, the long exposure period, the absence of any other obvious causes of fibrosis, as well as the radiological aspects found by conventional chest X-ray and CT, all pleaded for zirconium pneumo-coniosis.

The bronchial hyperresponsiveness syndrome may be an independent presence in an atopic subject, but in the literature there are information on the sensible potential of zirconium compounds.

REFERENCES

1. Bartter T, Irwin RS, Abraham JL et all - "Zirconium compound-induced pulmonary fibrosis". *Arch Intern Med 1991 Jun 151:6 1197-201.*
2. Cazzadori A, Romeo L, Bontempini L, Martini S - "Interstitial lung granulomas as a possible consequence of exposure to zirconium dust". *Med Lav 1994 May-Jun 85:3 219-22.*
3. Cocârlă A. - "Bronhopneumopatiile în mediul industrial". *Vol. II, 1985, 101.*
4. Falchi M., Paoletti L., Mariotta S. et all - "Non-fibrous inorganic particles in bronchoalveolar lavage fluid of pottery workers". *Occupational & Environmental Medicine, 53(11):762-766, November 1996.*
5. Frommel D, Ayranci B., Pfeifer HR. et all - "Podoconiosis in the Ethiopian. Role of Beryllium and Zirconium". *Tropical & Geographical Medicine. 45(4): 165-7, 1993.*
6. Kang KY., Bice D., Hoffman E. et all - "Experimental studies of sensitization to beryllium, zirconium and aluminum compounds in the rabbit". *Journal of Allergy & Clinical Immunology. 59(6):425-36, 1977 Jun.*
7. Kotter JM, Zieger G - "Sarcoid granulomatosis after many years of exposure to zirconium, "zirconium lung"". *Pathologe 1992 Apr 13:2 104-9*
8. Leininger JR., Farrell RL., Johnson GR. -"Acute lung lesions due to zirconium and aluminum compounds in hamsters". *Archives of Pathology & Laboratory Medicine. 101(10): 545-9, 1977 Oct.*
9. Liippo KK, Anttila SL, Taikina-Aho O et all - "Hypersensitivity pneumonitis and exposure to zirconium silicate in a young ceramic tile worker". *Am Rev Respir Dis 1993 Oct 148:4 Pt 1 1089-92.*
10. Montemarano AD., Sau P., Johnson FB. et all - "Cutaneous granulomatomas caused by an aluminum-zirconium complex: an ingredient of antiperspirants". *Journal of the American Academy of Dermatology. 37(3 Pt 1):496-8, 1997 Sept.*
11. Skelton HG 3d, Smith KJ, Johnson FB. et all - " Zirconium granuloma resulting from an aluminum zirconium complex: a previously unrecognized agent in the development of hypersensitivity granulomas". *J Am Acad Dermatol 1993 May 28:5 Pt 2 874-6.*
12. Werfel U, Schneider J, Rödelsperger K. et all - "Sarcoid granulomatosis after zirconium exposure with multiple organ involvement". *Eur Respir J 1998 Sep 12:3 750.*