PREVALENCE OF PNEUMOCONIOSES AMONG PHOSPHATE ROCK WORKERS IN BRAZIL

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INTRODUCTION

The phosphate rock as a pure chemical compound is defined as a calcium phosphate, $Ca_5(F, Cl)(PO_4)_3$. Its use in the fertilizer industry is well known all over the world and has increased since the 2nd world war end period. The industrial manipulation of that compound has brought concern about fluorose hazard by the treatment of the phosphate rock by H_2SO_4 or other strong acids to liberate phosphate rich compounds. Some respiratory illnesses mainly of upper airways were described related to this manipulation.[3,4,6,7,8,9,10] A very poor literature is available concerning pneumoconioses hazard linked with inhalation of the powdered rock.[1,2,6,6,16] In the same way, good reviews about pneumoconioses don't quote any information on phosphate rock pathogenicity.[16]

CRETEANU et al.,[2] in 1969 and PISLARU et al.,[15] in 1969 described 7 (seven) and 6 (six) cases of pneumoconioses in phosphate rock mill and transportation workers. Both of the papers did not tell us anything about the level of free silica in the samples of the inhaled rock. On the other hand, EL GAWABI & IBRAHIM[5] in 1975 described some cases of pneumoconioses in phosphate rock workers, but the analysis of the inhaled dust showed a high percentage of free silica and the lung disease was characterized as silicosis.

MATERIAL AND METHODS

The workers studied in this investigation were exposed to phosphate rock extracted in the states of Goiás and Minas Gerais, Brazil, where the material is crushed and then transported by train reaching Paulinia, state of São Paulo where the compound is stored in underground mills. The underground work and a twelve hours work shift every day, with only one day of rest each fortnight created a condition of very high risk to lung diseases.

Eighty one workers that had some kind of exposition to the rock dust were asked to participate of the study. During the investigation, eight (8) of them were put out of the study because they did not conclude all the proposed examinations. All the remanent 73 were submitted to a) occupational anamnesis; b) detailed respiratory questionnaire; c) physical examination emphasizing respiratory apparatus; d) pulmonary function tests using Collins Maxi Survey Computer Systems analyzing. The parameters analyzed were the CVF%; VEF_1/CVF and MMEF $FEF_{25/75}$;[12,13,14,17] e) thorax X-ray which were read by three readers in a blind schedule using the ILO Classification of Radiographs of pneumoconiosis 1980;[11] f) two workers were submitted to lung biopsies through thoracotomy. Tissue samples were stained by H.E., van Giemsa, Masson and argentic dye to found out fibrosis or even reticulin fibres; g) the quantity of free silica in the airborne samples was measured by colorimetric methods using Physical and Chemical Analysis Branch; h) a semiquantitative analysis was done with the airborne sample using an X-ray spectrometry EG 86 ORTEC.

RESULTS AND DISCUSSION

From the 73 examined workers we found 20[24,7] with pneumoconioses by X-rays characterization.

Trying to determine an average time of exposition for these 20 cases it was found a mean time of 46 months with a range from 12 to 73 months. CRETEANU et al.,[2] and PISLARU et al.,[15] found a mean time for their workers of 24 and 36 months respectively. The differences between ill and not ill workers concerning the smoke habit were not found significant. Relating to past inhalatory risk conditions, only one worker had previously worked in a fertilizer plant for a short period of time. The majority of the 20 cases didn't suffer from any respiratory symptoms (85%). Fourteen cases (70%) showed MEFF $FEF_{25/75}$ alterations; two cases (10%) mild restrictive patterns; three cases (15%) a pure obstructive pattern and five cases (25%) with normal patterns. Data from the study of CRETEANU et al. obstructive pattern in six of the seven cases. No correlation between time of exposition and lung function alterations was found.

Opacities in thorax X-rays were classified as small and round in 17 cases (85%) and small and irregular in 3 cases (15%). No pleura disease or mediastinum alterations were found (see Table I and Figure 1).

Lung biopsies were examined through optical microscopy. What appeared was a very extense deposit of brownish crystal material with focal refringence to polarized light in the perivascular, peribronquic and septa tissues, also occupying intra alveolar spaces. A mild histiocytary inflammatory reaction with alveolar collapses were also seen. Despite the use for special dyes to find out fibrosis or increased reticulin fibres, no significant fibrosis was seen (see Figures 2 and 3).

Diffraction analysis by EG 86 ORTEC showed relative amounts of Ca, P, Fe, Mn, Si, Ti, Ba, Nb and S. Small quantities of Fluoride are not detectable by this method but it is

Table I
Thorax X-rays Alterations in the 20 Cases of Pneumoconioses

radiologic alterations			nº	%
	round	p	10	50
small		q	7	35
opacities	irregular	s	1	5
		t	2	10
	total		20	100

clear this element exists in the composition of that rock. Despite the good sensitivity of the method for free silica, not even traces were found. Colorimetric methods showed free silica in less than 1% of the total inhaled dust.

CONCLUSIONS

From the results one can conclude about the non fibergenicity of this pneumoconioses, at least with the available data. A prospective study must be carried out to assess the former statement. A regular follow-up using lung function tests and thorax X-rays must be included in the routine examinations of the phosphate rock workers. The actual etiology of that pneumoconioses should be studied using electronic microscopy linked with microanalysis by X-rays diffraction.[18] The high prevalence of pneucomonioses found in this study must derive from the specially bad conditions for working people were submitted at this plant.

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Figures not provided.

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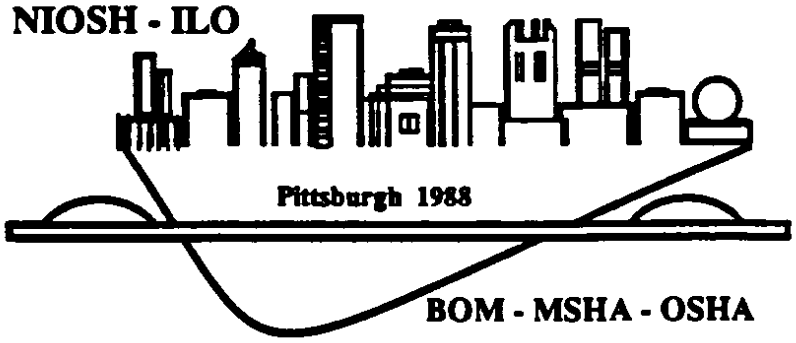

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