

ROLE OF EXERCISE TESTS IN THE FUNCTIONAL EVALUATION OF SILICOTIC PATIENTS

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INTRODUCTION

Evaluation of labor capacity is frequently requested for patients with pneumoconioses. Spirometry and chest X-rays usually utilized in the diagnosis, have not been regarded as good predictors of pulmonary disability; and have poor correlation with the respiratory symptoms.^{3,8,9}

Among the methods utilized in the functional evaluation of pneumoconioses, the exercise tests have emerged as useful, for evaluating the cardiorespiratory abnormalities, not present at rest.^{1,2}

Although the exercise tests have been frequently utilized in the differential diagnosis of dyspnea,^{4,10,12,13} in occupational medicine, the studies are scattered and utilized diverse methodology, making difficult the comparison of the results.^{6,7,11}

Objectives

In this study, our purpose was to establish the role of the cardiorespiratory, metabolic and gas exchange analysis during exercise, in evaluating ceramic workers with the diagnosis of silicosis; and to correlate these findings with the degree of dyspnea, the radiological alterations and the pulmonary function tests at rest.

METHODS

Casuistic

We have studied forty three ceramic workers with the diagnosis of silicosis based on the occupational history of silica dust exposure and on the radiographic features. They were separated in three groups, based in the ILO Classification, 1980 (Table I).⁵

The characteristics of the patients, the silica dust and the smoking exposure were not significantly different when compared to the three groups. However, group III subjects, were older than the ones of Group I.

Protocol

The patients were first submitted to a clinical evaluation and thereafter tested for spirometry, flow-volume curves and arterial blood gases at rest.

Secondly, they went to an incremental exercise test on a cycloergometer to the maximum tolerance, for cardiovascular, ventilatory and metabolic evaluation (n = 40).

Finally, after 30 min. of resting, the patients were submitted to a submaximal test corresponding to 50% of the maximum tolerance, for the analysis of the cardiorespiratory and metabolic responses and the arterial blood gases.

Table I
Classification of the Silicotic Patients, According to the ILO Classification, 1980⁵

GROUP	OPACITIES/PROFUSION	n
I	Small Opac. (up to 3mm) 1/0 to 1/2	21
II	Small Opac. (up to 3mm) 2/1 to 3/3	13
III	Large opac. (A, B or C)	9

RESULTS AND COMMENTS

Dyspnea was the most frequent symptom, being reported by 26 (61%) of the patients, with similar distribution and intensity in the three groups (Figure 1). Cough, sputum production and bronchospasm, also had similar incidence among the patients.

The spirometry was altered in 14 subjects (33%), also with similar distribution in the groups I, II and III. There was no predominant pattern of respiratory impairment (obstructive or restrictive) and most patients had slight to moderate abnormalities (Figures 2 and 3).

In the analysis of flow-volume curves ($n = 41$), the \dot{V}_{\max} 25% was the only variable that distinguished Group III from the other groups, being altered in 52% of subjects in Group I, 42% in Group II and 88% in Group III (Table III).

In the incremental exercise tests ($n = 40$), the patients of Group III had lower $\dot{V}O_{2\max}$ compared to Group I and II ($p < 0.05$ —Gr. I vs. Gr. III) (Table IV). The symptoms reported at the interruption of exercise were mostly dyspnea and leg pain, with similar distribution and intensity in the three groups. A value of $\dot{V}O_{2\max} < 70\%$ Pred., indicating some degree of functional limitation was found in 14 patients, however with different distribution in the three groups: 3 of them were from Group I (16%), 4 from Group II (31%) and 7 (88%) were from Group III ($p < 0.05$ —Group I + II vs. Group III) (Figure 4). This indicates an association between the more severe X-ray alterations and the lower working tolerance. However there were subjects of Group I, with reduced exercise capacity and conversely, subjects of Group III with normal exercise capacity (Figure 4).

No correlations were found between the exercise capacity

Table II
Characteristics of the Silicotic Patients

\bar{X}		AGE	Wt	Ht	Silica Dust	Smoking	
GR.	n	(yrs)	(kg)	(cm)	Exposition (yrs)	%	Pack/years
I	21	39.3	72.8	169	18.2	53	16.0
II	13	42.4	73.9	170	21.1	61	18.5
III	9	51.1*	65.4	165	22.6	33	29.0

* $p < 0.05$ - Gr. III > Gr. I. Kruskal-Wallis analysis of variance, and Dunn contrast test.

%: percent of smokers in each group.

Table III
Flow-Volume Curve Variables in Silicotic Patients of the Three Groups

\bar{X}		\dot{V}_{\max}		\dot{V}_{\max} 50%		\dot{V}_{\max} 25%	
GR.	n	l/seg % Pred		l/seg % Pred		l/seg* % Pred*	
I	21	7.26	88	3.79	67	1.81	65
II	12	8.09	95	4.29	75	1.83	64
III	8	5.51	71	2.47	46	0.99	33

* $p < 0.05$ - I > III, II > III (l/seg); I > III (% Prev.)
Kruskal-Wallis analysis of variance, and Dunn contrast test.

Table IV
Maximal Exercise Test Variables, Obtained in the Patients of the Three Groups

GROUP	n	WORK LOAD* (watts)	$\dot{V}O_2\text{max}$ § (l/min)	% Pred §	FCmax bpm	% Pred
I	19	191	2.32	86.5	150	83
II	13	189	2.35	89.2	149	82
III	8	103	1.24	55.1	128	75

p < 0.05 - *Gr. I and II > III; § Gr. I > III. Kruskal-Wallis analysis of variance and Dunn contrast test.

of the patients and the clinical symptoms or the pulmonary function tests at rest.

The arterial blood gases at rest and during exercise were similar to the three groups; and the percentual frequency of hypoxemia and of decrease in PaO_2 < 5 mmHg (rest-exercise) was not significantly different when compared to the groups I, II and III. As the pulmonary function tests, the analysis of blood gases at rest and during exercise did not correlate with the exercise tolerance and the radiological changes of the patients (Figure 5).

Summarizing, the evaluation of the silicotic patients during an exercise test, revealed a certain number of incorrect prediction of working capacity, based on the resting data.

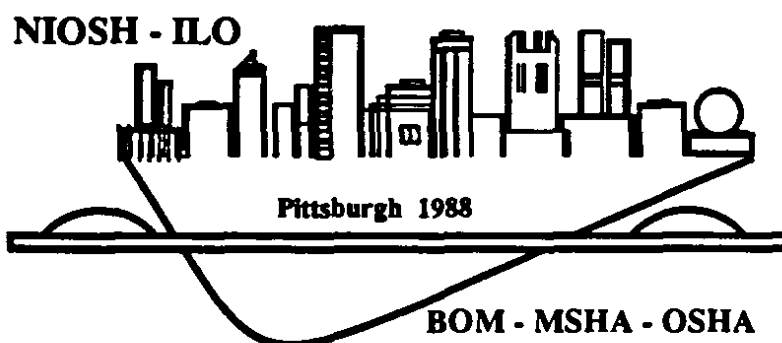
We concluded that the functional analysis during exercise can complete or modify the clinical, radiological and pulmonary function test analysis, in evaluating the impairment of patients with pneumoconioses.

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